NIMAL BIOGRAPHY,

OR

POPULAR ZOOLOGY;

COMPRISING

AUTHENTIC ANECDOTES

OF

THE ECONOMY,

HABITS OF LIFE, INSTINCTS, AND SAGACITY,

OF THE

ANIMAL CREATION.

ARRANGED ACCORDING TO THE SYSTEM OF LINNÆUS.

BY THE REV. W. BINGLEY, A. M.

FELLOW OF THE LINNEAN SOCIETY,

AND LATE OF PETERHOUSE, CAMBRIDGE.

IN THREE VOLUMES.

FOURTH EDITION,

With an Addition of more than One Hundred and Forty Species.

VOL. III.

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Bat, common
——, long-eared
——, noctule
——, barbastelle
——, horse-shoe
Seal, common
Dog, shepherd's
——, water
——. Spaniel
——. Setter
——. Pointer
——. Hound
——. Bloodhound
——. Irish Greyhound
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Fox
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Cattle, wild
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———, Lancashire
———, Alderney
———, Highland Stot
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———, cart
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ANIMAL BIOGRAPHY.

FISHES*.

Apodal Fish†.

OF THE EEL TRIBE IN GENERAL‡.

THE Apodal Fish, of which the Eel forms the first Linnæan tribe, in their appearance and manners, approach, in some instances, very nearly to the serpents. They have a smooth and slippery skin, in general naked, or covered only with small, soft, and distant scales. Their bodies are long and slender, and they are supposed to live entirely on animal substances.

There are about nine species, most of which are found only in the seas. One of these frequents our fresh waters, and three others occasionally visit our shores.

* For an account of Fishes in general, see vol. i. p. 36.

† The fishes of the Linnæan order *Apodes*, have bony gills, and no ventral fins.

‡ The Eels have a smooth head, and tubular nostrils. Their gill-membrane has ten rays. The body is nearly cylindrical, smooth, and slippery. The tail, and the back and anal fins, are united. The spiracle is behind the head or the pectoral fins.

THE COMMON EEL*.

The Common Eel evidently forms a connecting link, in the chain of nature, between the serpents and the fishes, possessing not only, in a great measure, the serpent form, but also many of their habits.

It is frequently known to quit its own element, and to wander, in the evening or night, over meadows, in search of snails and other prey, or to other ponds for change of habitation. This will account for Eels being found in waters that have not been in the least suspected to contain them. An instance of this rambling spirit of the Eel is mentioned in Plott's Natural History of Staffordshire; and, from the following lines of Oppian, it appears to have been known to the antients:

> Thus the mail'd Tortoise, and the wand'ring Eel,
> Oft to the neighbouring beach will silent steal.

Mr. Arderon, in the Philosophical Transactions, says, that in June, 1746, while he was viewing the flood-gates belonging to the water-works of Norwich, he observed a great number of Eels sliding up them, and up the adjacent posts, to the height of five or six feet above the surface of the water. They ascended with the utmost facility, though many of the posts were perfectly dry, and quite smooth. They first thrust their heads and about half their bodies out of the water, and held them against the wood-work for some time; Mr. Arderon imagines, till they found the viscidity of their bodies sufficiently thick, by exposure to

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§ SYNONYMS. Muræna Anguilla. *Linnæus.*—L'Anguille, in France.

the air, to support their weight. They then began to ascend directly upwards, and with as much apparent ease as if they had been sliding on level ground; this they continued till they had got into the dam above.

Of the migration of young Eels from one part of a river to another, an instance is related by Dr. Anderson, in his publication called The Bee. "Having occasion (says this gentleman) to be once on a visit at a friend's house on Dee-side, in Aberdeenshire, I often delighted to walk by the banks of the river. I one day observed something like a black string moving along the edge of the river in shoal water. Upon closer inspection I discovered that this was a shoal of young Eels, so closely joined together as to appear, on a superficial view, one continued body, moving briskly up against the stream. To avoid the retardment they experienced from the force of the current, they kept close along the water's edge the whole of the way, following all the bendings and sinuosities of the river. Where they were embayed, and in still water, the shoal dilated in breadth, so as to be sometimes nearly a foot broad; but when they turned a cape, where the current was strong, they were forced to occupy less space, and press close to the shore, struggling very hard till they passed it.

"This shoal continued to move on night and day, without interruption, for several weeks. Their progress might be at the rate of about a mile an hour. It was easy to catch the animals, though they were very active and nimble. They were Eels perfectly formed in every respect, but not exceeding two inches in length. I conceive that the shoal did not contain, on an average, less than from twelve to twenty in breadth; so that the number which passed on the whole, during their progress, must have been very great. Whence they came, or whither they went, I know not. The place where I remarked them

at, was six miles from the sea, and I am told that the same phænomenon takes place every year about the same season."

The usual haunts of Eels are in mud, among weeds, under the roots or stumps of trees, or in holes in the banks or the bottom of rivers. They are partial to still waters, and particularly to such as are muddy at the bottom. Here they often grow to an enormous size, sometimes weighing fifteen or sixteen pounds.—One that was caught near Peterborough, in the year 1667, measured a yard and three quarters in length.

When kept in ponds they have been known to destroy young ducks. Sir John Hawkins, from a canal near his house at Twickenham, missed many of the young ducks; and, on draining, in order to clean it, great numbers of large Eels were discovered in the mud. In the stomachs of many of them were found, undigested, the heads and part of the bodies of the victims.

Eels seldom come out of their hiding-places but in the night, during which time they are taken with lines that have several baited hooks.—In winter they bury themselves deep in the mud, and, like the serpent tribe, remain in a state of torpor. They are so impatient of cold, as eagerly to take shelter even in a whisp of straw, if flung into a pond in severe weather. This has sometimes been practised as a mode of catching them.

Eels are viviparous.—They are so tenacious of life, that their parts will continue to move for a considerable time after they are skinned and cut into pieces; and no other fish whatever will live so long out of the water as these. They are best in season from May to July; but may be caught with a line till September. When the water is thick with rains they may be fished for during the whole day; but the largest and best are caught by

night-lines. The usual baits are dew-worms, minnows, or gudgeons.

THE CONGER EEL*.

When at its full size the Conger Eel has sometimes been known to measure more than ten feet in length, and from fourteen to sixteen inches in circumference. It is one of the most dangerous and most powerful enemies with which the fishermen of the British islands have to contend. Being usually caught by a hook and line, it requires some care to land and kill the large ones without injury. We are informed, that on such occasions they have been known to entwine themselves round the legs of a fisherman, and to fight with the utmost fury. A Conger, six feet in length, was caught in the Wash at Yarmouth, in April, 1808; but not until after a severe contest with the man who had seized it. The animal is stated to have risen half erect, and to have actually knocked him down before he could secure it. This Conger weighed only about sixty pounds, whilst some of the largest exceed even a hundred weight.

The voracity of these fishes is enormously great. They oftentimes lie concealed, in the mud or sand, at the mouths of large rivers, for the purpose of seizing upon any prey which passes either in or out. If this happen to be so large as not otherwise to be immediately overcome, we are

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* Description. The Conger differs from the Common Eel principally in having the lower jaw shorter than the upper; and in the lateral line being whitish, with a row of spots. The colour of the body also is darker; and the edges of the dorsal and anal fins are black. The eyes also are, in proportion, larger; and the irides of a bright silvery colour.

Synonyms. Muræna conger. *Linn.*—La Murène congre. *La Cepede.*—Le Congre. *Bloch.*—Heawe Eel, in Scotland.—Elvers, the young ones.

told that the Conger will coil its body round, and thus prevent its escape; whilst, in the mean time, it kills it by means of its teeth. It devours great quantities of the different species of cuttle-fish, and other soft marine animals, which have not sufficient agility or address to escape from its pursuit.

Until the Congers are grown to a size so large that they are able stoutly to defend themselves, they are liable to attack from numerous foes. The wolf-fish *, all the larger species of rays, and even the sea craw-fish †, and lobsters, destroy them in vast numbers.

During the winter months it is said that these fish conceal themselves deep in the mud; and that, so long as the cold weather lasts, they seldom come forth from their retreat. They are occasionally found on almost all the shores of Great Britain and Ireland; and in some places in vast abundance. From Mount's Bay in Cornwall, there have, in some years, been upwards of ten ton weight of dried Congers exported to different parts of Spain and Portugal.

They are here principally caught with strong lines, each about five hundred feet in length, and having sixty hooks, about eight feet asunder. These lines, (which are called *bulters*) are sunk at one end by means of a stone, or other weight, sufficiently heavy to prevent the action of the waves from moving them. In some instances the fishermen fasten several of the lines together, making the whole sometimes to extend nearly a mile in length.

The flesh of the Conger is white, and is considered by some persons as good eating: to others, on the contrary, it is extremely disgusting, as it is certainly both coarse and greasy.

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* *Anarichas lupus* of Linnæus.

† *Cancer homarus* of Linnæus.

*OF THE GYMNOTUS TRIBE IN GENERAL**.

Some of the species of Gymnotus inhabit the fresh waters, and others live in the ocean. They are all, except three, confined to the New Continent.

THE ELECTRICAL GYMNOTUS OR EEL †.

These fishes possess the singular property of giving a shock, (similar in its effects to that produced from a charged jar,) to any body, or any number of bodies connected together. In different publications, domestic and foreign, we have numerous accounts of experiments on the Electric Eel; the best of them seem those inserted in the Philosophical Transactions, by Dr. Williamson and Dr. Garden.

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* The head is furnished with lateral opercula; and there are two tentacula on the upper lip. The gill-membrane has five rays. The body is compressed, and has a fin running along the under parts.

† DESCRIPTION. On a transient view, this fish bears a great resemblance, both in shape and colour, to the common eel. It is from three to four feet in length; and, in the thickest part of its body, ten or twelve inches in circumference. The head is flat, and the mouth wide, and destitute of teeth. A fin about two inches deep extends from the point of its tail to within six inches of the head; and, where it joins the body, this fin is almost an inch thick. Across the body there are several annular divisions, or rather rugæ of the skin, from which the fish should seem to partake of a vermicular nature, and to have the power of contracting or dilating itself at pleasure. It is able to swim backward as well as forward.

This most singular fish is peculiar to South America, where it is found only in the rocky parts of rivers, at a great distance from the sea.

SYNONYMS. Gymnotus electricus, *Linn.*—Cold Eel. *Smith.*—Cramp-fish, Numbing Eel, by the English.—Beave Aal, by the Dutch.—Electric Eel, *Phil. Trans.*—Anguille tremblante, by the French.

The former of these gentlemen says, that on touching an Electrical Eel with one hand, a sensation is experienced similar to that arising from touching the conductor of an electrical machine: with a short iron rod the same was felt, but less powerfully. While another person provoked the fish, Dr. W. put his hand into the water, at the distance of three feet from it, and felt an unpleasant sensation in the joints of his fingers. Some small fish were thrown into the water, and the animal immediately stunned and swallowed them. A larger fish was thrown in, which he stunned likewise, and attempted to swallow; but, from its size, he could not do it. Dr. W. put his hand into the water, and had another fish thrown in at some distance. The Eel swam up to it, and at first turned away without offering it any violence: after a little time he returned, and, looking stedfastly at it a few seconds, gave it a shock, by which it instantly turned upon its back, and became motionless. Dr. W. at that very instant felt the same sensation in his fingers as when he put his hand into the water before. A fish was afterwards struck, but not quite killed: when the Electric Eel perceived this he returned, and at a second shock, evidently more severe than the former, rendered it motionless. On touching it with one hand so as to provoke it, and holding the other in the water at a little distance, a severe shock was felt through both the arms, and across the breast, similar to that from a charged jar. Eight or ten persons, with their hands joined, experienced the same, on the first touching the head, and the last the tail of the fish. A dog being made a link in this chain, at the instant of contact uttered a loud yell. When the Eel was touched with silk, glass, or any other non-conductor, no shock whatever was felt. From a long series of experiments, it appeared to Dr. Williamson that these properties partook so nearly of the nature of electricity, that whatever would convey the electrical fluid, would also convey the fluid

discharged by the Eel; and *vice versâ*. He, however, was never able to observe that any spark was produced on contact. This mode of defence the fish never adopted except it was irritated; and Dr. W. has passed his hand along the back and sides from head to tail, and even lifted part of its body out of the water, without tempting it to injure him.

Mr. Bryant mentions an instance of the shock being felt through a considerable thickness of wood.—One morning, while he was standing by, as a servant was emptying a tub, in which one of these fish was contained, he had lifted it entirely from the ground, and was pouring off the water to renew it, when he received a shock so violent as occasioned him to let the tub fall. Mr. B. then called another person to his assistance, and caused them together to lift up the tub, each laying hold only on the outside. When they were pouring off the remainder of the water, they each received a shock so smart, that they were compelled to desist.

Persons have been knocked down with the stroke. One of these fish being shaken from a net upon grass, an English sailor, notwithstanding all the persuasions that were used to prevent him, would insist on taking it up; but the moment he grasped it, he dropped down in a fit; his eyes were fixed; his face became livid; and it was not without difficulty that his senses were restored. He said that the instant he touched it, "the cold ran swiftly up his arm into his body, and pierced him to the heart."

A negro, who attempted to grasp a large fish firmly with his hands, had, in consequence, a confirmed paralysis in both his arms.

Dr. Garden says, that, for a person to receive a shock from the Electrical Eel, it is necessary to take hold of the fish with both hands, at some considerable distance from each other, so as to form a communication betwixt them. He held a large one several times by one hand without

receiving a shock, but he never touched any of them with both his hands without feeling a smart shock. The remainder of his experiments, though not so numerous, tend to confirm the truth of those that were made by Dr. Williamson.

The account of Captain Stedman differs from the above in one material point: he says, that it is by no means necessary to grasp the animal with both hands to receive the shock, having himself experienced the contrary effect. For a small wager he attempted several times to seize an Electrical Eel with one hand, and at every trial he had a severe shock, which extended to the top of his shoulder; and after about twenty different attempts, to no purpose, he was compelled to desist.

This property seems principally of use to the Electrical Eels in securing their food; for, being destitute of teeth, they would otherwise be scarcely able to seize it. The force of the shock has been satisfactorily proved to depend entirely on the will, and to be exerted as circumstances require. Their prey are generally so stunned by the shock, as to appear dead; but when these have been taken into another vessel, they been always found to recover.—When the Electrical Eels are hungry, they are tolerably keen after their food; but they are soon satisfied, not being able to contain much at one time. One of them, three feet and upwards in length, could not swallow a fish above three, or at most three inches and a half long.

The organs that produce this wonderful accumulation of electric matter, constitute nearly one half of that part of the flesh in which they are placed, and, perhaps, compose more than one third of the whole animal. There are two pairs of these organs, one on each side. Their structure is very simple and regular, consisting only of flat partitions, with cross divisions between them. The partitions

are thin membranes placed nearly parallel to one another, and of different lengths and breadths. Their distances from each other differ with the size of the fish: in one of two feet four inches in length, they were found to be $\frac{1}{92}$nd of an inch asunder. They appear to answer the same purpose with the columns of the torpedo, making walls or butments for the subdivisions, and are to be considered as forming so many distinct organs; they are very tender, and easily lacerated. These are furnished with many pairs of nerves appropriated to their management; but how such surprising effects are produced by means of organs of this description, in a fluid also extremely ill-adapted to the purpose, has not yet been satisfactorily explained.

These Eels are sometimes caught in Guiana, when very young, and preserved in large troughs filled with water, for amusement. They are usually fed with small fish, earth-worms, or cock-roaches, the latter of which are the most agreeable of all food to them.

OF THE SWORD-FISHES IN GENERAL.*

These are very large and powerful animals, oftentimes growing to the length of twenty feet and upwards. Their voracity is unbounded, for they attack and destroy almost every thing living that comes in their way. The larger fish they penetrate with their long snout, few of which, when within sight of them, can either withstand or avoid its shock. There are only two species, one of which only is found in the European seas.

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* The head of the Sword-fish is furnished with a long, hard, sword-shaped, upper jaw. The mouth has no teeth. The gill membrane is eight-rayed; and the body is rounded, and has no apparent scales.

THE BROAD-FINNED* AND THE EUROPEAN SWORD-FISH †.

The former of these inhabit the Brasilian and East-Indian Seas, and also the Northern Ocean. They frequently grow to the length of twenty feet or upwards, and are very powerful fish.

When his majesty's ship Leopard, after her return from the coast of Guinea and the West-Indies, was ordered, in 1725, to be cleaned and refitted for the Channel service, in stripping off her sheathing, the shipwrights found in her bottom, pointing in a direction from the stern towards the head, part of the sword or snout of one these fishes. On the outside, this was rough, not unlike seal-skin, and the end, where it was broken off, appeared like a coarse kind of ivory. The fish, from the direction in which the sword lay, is supposed to have followed the ship when under sail. It had penetrated through the

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* Description. The body of the Broad-finned Sword-fish, is of a silvery bluish white, except the upper parts of the back, and the head and tail, which are of a deep brown. The skin is smooth, and without any appearance of scales. From the long sharp-pointed process in front of the head, it would seem, on a cursory view, to be allied to the European species; but it differs from this, in having an extremely broad back-fin, and two long sharp-pointed appendages proceeding from the thorax.

Synonyms. Xiphias platypterus. *Shaw.*—Indian Sword-fish, Sword-fish. *Var.*—Broad-finned Sword-fish. *Shaw's Nat. Mis.*

† Description. This species differs from the former principally in having its dorsal-fin falcate or scythe-shaped, and in being destitute of the two long and sharp appendages on the thorax.

Synonyms. Xiphias gladius. *Linnæus.*—Le Xiphias Espadon. *La Cepede.*—L'Empereur. *Bloch.*—L'Espadon, ou L'Epée de mer, in France.—Sicilan Sword-fish. *Pennant.*—*Penn. Brit. Zool. tab.* 26.

sheathing, which was an inch thick, passed through three inches of plank, and beyond that, four inches and a half into the timber. The force requisite to effect this, (since the vessel sailed in a direction from the fish,) must have been excessively great, especially as no shock was felt by the persons on board. The workmen on the spot declared that it would be impossible, with a hammer of a quarter of a hundred weight, to drive an iron pin of the same form and size into that wood, and to the same depth, in less than eight or nine strokes, whilst this had been effected by only one.

And about sixteen years ago, a letter was written to Sir Joseph Banks, as president of the Royal Society, from the captain of an East-Indiaman, accompanied with an account of another instance of the amazing strength which this fish occasionally exerts—the bottom of his ship being pierced through in such a manner, that the sword was completely imbedded, or driven through its whole length, and the fish killed by the violence of the effort. A part of the bottom of the vessel, with the sword imbedded in it, is now lodged in the British Museum.

The Sword-fish and the whale are said never to meet without coming to battle; and the former has the repute of being always the aggressor. Sometimes two of them join against one whale; in which case the combat is by no means equal. The whale uses his tail only in his defence: he dives down into the water, head foremost, and makes such a blow with this, that, if it take effect, finishes the Sword-fish at a stroke: but the other, who in general is sufficiently adroit to avoid it, immediately falls upon the whale, and buries his weapon in his sides. When the whale discovers the Sword-fish darting upon him, he dives to the bottom, but is closely pursued by his antagonist, who compels him again to rise to the surface. The battle then begins afresh, and lasts until the Sword-fish

loses sight of the whale, who is at length compelled to swim off, which his superior agility allows him to do. In the Sword-fish piercing the whale's body with the tremendous weapon at his snout, he seldom does any great damage to the animal, from not being able to penetrate much beyond the blubber.

The European Sword-fish has sometimes been found on the British coasts; and is very common in the Mediterranean.

Jugular Fish*.

OF THE COD TRIBE IN GENERAL†.

This is a numerous tribe, inhabiting only the depths of the ocean, and seldom visiting the fresh waters. They are in general gregarious, and feed on the smaller fish and other marine animals. The flesh of most of them is white, firm, and good eating.

THE COMMON COD‡.

These fish are found only in the seas of the northern parts of the world; and the great rendezvous for them are the sand-banks of Newfoundland, Nova Scotia, and New England. These shallows are their favourite situations; for here they are able to obtain great quantities of worms, a food that is peculiarly grateful to them. Another cause of their attachment to these places, is their vicinity to the polar seas, where they return to spawn. There they deposit their roes in full security, and afterwards repair, as

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* The fishes of the Linnean order *Jugulares*, have bony gills, and ventral fins before the pectoral ones.

† The head in the Cod-fish is smooth; and the gill-membrane has seven rays. The body is oblong, and covered with deciduous scales. The fins are all covered with the common skin. The rays of the fins are unarmed; and the ventral fins are slender, and terminate in a point.

‡ SYNONYMS. Gadus morhua. *Linn.*—Cod-fish or Keeling. *Ray.*—La Morue, in France.

soon as the first more southern seas are open, to the banks for subsistence.—Few are taken north of Iceland, and the shoals never reach so far south as the Straits of Gibraltar.

Prior to the discovery of Newfoundland, the principal fisheries for Cod were in the seas off Iceland, and off the western islands of Scotland. To the former of these, the English resorted nearly four hundred years ago. In the reign of James the First, we had no fewer than 150 vessels employed in the Iceland fishery.

The chief fisheries now, are in the Bay of Canada, on the great bank of Newfoundland, and off the isle of St. Peter, and the isle of Sable. The vessels frequenting these fisheries, are from a hundred to two hundred tons burthen, and will catch 30,000 Cod or upwards each. The hook and line are the only implements employed in the taking of these fish; and this in a depth of water of from sixteen to sixty fathoms.—The great bank of Newfoundland, is represented to be like a vast mountain, above five hundred miles long, and nearly three hundred broad; and the number of British seamen employed upon it, is supposed to be about fifteen thousand.

The best season for fishing, is from the beginning of February, to the end of April: and though each fisherman takes no more than one fish at a time, an expert hand will sometimes catch four hundred in a day. The employment is excessively fatiguing, from the weight of the fish, and the great coldness of the climate.

As soon as the Cod are caught, the heads are cut off; they are opened, gutted, and salted: they are then stowed in the hold of the vessel, in beds five or six yards square, head to tail, with a layer of salt to each layer of fish. When they have lain here three or four days to drain off the water, they are shifted into a different part of the vessel, and again salted. Here they remain till the vessel

is loaded. Sometimes they are cut into thick pieces, and packed in barrels, for the greater convenience of carriage.

Cod are taken by the natives of Norway, off their own coast, in strong packthread nets. These have meshes four inches square, and are about a fathom or fifteen meshes deep, and twenty fathoms long. They use, according to the weather, from eighteen to twenty-four of these nets joined, so that they have sometimes upwards of four hundred fathoms of net out at a time. They fish in from fifty to seventy fathom water, and mark the places of the nets by means of buoys. The afternoon is the time when the nets are generally set; and, on taking them in on the following morning, it is no uncommon thing to obtain three or four hundred fine Cod.

In the Newfonndland fishery, the *sounds*, or air-bladders, are taken out previously to incipient putrefaction, washed from their slime, and salted for exportation. The tongues also are cured, and brought in barrels containing four or five hundred pounds weight each. From the livers a great quantity of oil is extracted.

In Lapland, and some of the districts of Norway, the Cod and Torsk*, which are taken in the winter, are carefully piled up, as they are caught, in buildings constructed for the purpose, having their sides open, and exposed to the air. Here they remain frozen until the following spring, when, the weather becoming more mild, they are removed to another building of like construction, in which they are prepared for drying. The heads are cut off, the entrails taken out, and the remainder of the body is hung up in the air. Fish caught in the spring, are immediately conveyed to the second house, and dried in the above manner. Those that are caught during the summer season, on account of the heat of the weather,

* Another species, *gadus callarias* of Linnæus.

can only be preserved by the common methods of curing with salt.

These fish feed principally on the smaller species of the scaly tribes, on worms, shell-fish, and crabs: and their digestion is sufficiently powerful to dissolve the greatest part even of the shells which they swallow.

They are so extremely prolific, that Leeuwenhoek counted above nine millions of eggs in the roe of a middling-sized Cod-fish. The production of so great a number will surely baffle all the efforts of man, or the voracity of the inhabitants of the ocean, to diminish the species so greatly, as to prevent its affording an inexhaustible supply of grateful provision in all ages.

In the European seas, the Cod begin to spawn in January, and they deposit their eggs in rough ground among rocks. Some continue in roe until the beginning of April. They recover very quickly after spawning, and good fish are to be taken all the summer. When they are out of season, they are thin-tailed and lousy. Cod-fish are chosen for the table, by their plumpness, and roundness near the tail; by the depth of the hollow behind the head, and by the regular undulated appearance of the sides, as if they were ribbed.

Cod frequently grow to a very great size. The largest that is known to have been taken in this kingdom, was at Scarborough, in the year 1775: it measured five feet eight inches in length, and five feet in circumference, and weighed seventy-eight pounds. The usual weight of these fish is from fourteen to forty pounds.

THE HADDOCK*.

Haddocks migrate in immense shoals, which usually arrive on the Yorkshire coasts about the middle of winter.

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* SYNONYMS. Gadus æglefinus. *Linnæus.*—L'Aigrefin, in France.

These are sometimes known to extend, from the shore, nearly three miles in breadth, and in length from Flamborough Head to Tinmouth Castle, nearly fifty miles, and perhaps even much further northwards. An idea of their numbers may be had from the following circumstance: three fishermen, within a mile of the harbour of Scarborough, frequently loaded their boat with them twice a day, taking each time about a ton of fish. The large ones quit the coast as soon as they are out of season, and leave behind them great plenty of small ones. The former are supposed to visit the coasts of Hamburgh and Jutland during the summer.

The larger ones begin to be in roe in November, and continue so for somewhat more than two months: from this time till May they are reckoned out of season. The small ones are extremely good from May till February; and those that are not old enough to breed, for even two months afterwards.—Haddocks seldom grow to any great size; they very rarely become so large, as to weigh twelve or fourteen pounds; and they are esteemed more delicate eating, when they do not exceed three pounds in weight.

In Greenland, according to the observation of Otho Fabricius, these fish remain near the bottom of the water during the day time; but in the evening they approach the surface. It is then that the fishermen are able to catch them, generally in immense numbers. Sometimes they may be observed to leap quite out of the water, for the purpose of avoiding the dog-fish, and their other enemies of the deep.

In tempestuous weather, Haddocks are said to seek for shelter in the sand or mud, or among sea-weeds. They feed on various small marine animals, and frequently become fat on herrings.

The females spawn about the month of February, at

which time they approach the shores in great numbers, for the purpose of depositing their ova upon the sea-weeds. The males come separately afterwards, in order to render the eggs productive.

On each side of the body, just beyond the gills, there is a dark spot. Superstition asserts, that when St. Peter took the tribute money out of the mouth of a fish of this species, he left the impression of his finger and thumb, which has ever since been continued to the whole race of Haddocks.

THE WHITING *.

It is principally near the bottom of the sea, that the Whiting resides. Here it feeds on various species of crabs and lobsters, on molluscæ, and young fish. In its stomach there are oftentimes found both sprats and young herrings. With these the fishermen frequently bait their hooks for the catching of Whiting: they also occasionally bait with marine worms and muscles.

Whitings are generally caught off certain parts of the French coasts, in the months of January and February; but, in Holland and England, during the summer season. They sometimes approach the English coasts in such numbers, that their shoals have been known occasionally to extend three or four miles in length, and upwards of a mile in breadth.

They are sometimes caught by means of nets, but lines are generally preferred. Where a fishery is well attended to, these lines are of immense length, and furnished with as many as from a hundred and fifty to two hundred

* SYNONYMS. Gadus merlangus. *Linnæus.*—Le gade Merlan. *La Cepede.*—Le Merlan, in France.

hooks. One vessel will put out twenty of these lines, having in the whole nearly four thousand hooks. As these fish pursue the shoals of herrings with great eagerness, they are often caught in the herring nets.

It is from the end of December until about the beginning of February, that Whitings usually approach the shores, for the purpose of depositing their eggs amongst the sea-weeds. Towards the latter part of this season, the flesh, which at all other times of the year is tender, white, and well-flavoured, becomes soft and insipid, and the animals themselves are thin and emaciated.

The flesh of the Whiting is, in some countries, considered so easy of digestion, as to be generally prescribed to those persons whose digestive powers are much impaired. This quality of the flesh gave rise to an ancient adage, that "the Whiting is never heavier in the stomach than it is when suspended to the waist."

THE LING *, AND HAKE †.

After the herring, the pilchard, and the cod, the Ling may, in a commercial view, be considered as the most

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* DESCRIPTION. The Ling is usually from three to four feet in length. The body is slender, and generally of an olive colour above, and white below. On the chin there is a single cirrus or beard; and the lower jaw is shorter than the upper one. There are two dorsal fins, the second of which extends nearly to the tail. The ventral fins are white; and the dorsal and anal fins are edged with the same. The tail is tipped with white, but has a transverse bar of black near the end.

SYNONYMS. Gadus Molva. *Linnæus.*—Le Lingue. *La Cepede. Bloch.*

† DESCRIPTION. The general length of the Hake, is from two to three feet. The upper parts of the body are cinereous, and the lower parts dirty white. The mouth has no cirrus, and the lower

important of all fish. Nine hundred thousand pounds weight of Ling are annually exported from Norway. In England they are fished for, and cured in somewhat the same manner as the cod. Those which are caught off the shores of America, are by no means so much esteemed as those which frequent the coasts of Great Britain and Norway. And the Ling in the neighbourhood of Iceland are so bad, that the inhabitants are unable to find a sale for them in any country except their own. With us they are chiefly abundant amongst the Hebrides, and on the coast of Yorkshire.

They generally remain near the bottom of the sea, where they prey on crabs, lobsters, and various small kinds of fish, particularly on plaise and flounders. Bloch found in the stomach of one of them, several young plaise and gurnards. They spawn about the month of June, depositing their ova in muddy bottoms, and amongst sea-weed, near the mouths of rivers.

They are in season from February until about the end of May. During this time the liver is white, and yields a great quantity of fine and well-flavoured oil. A kind of isinglass is made from the air-bladders. The tongues are eaten either fresh, dried, or salted.

The *Hake* is found in the Mediterranean, in the British Channel, and in the North Sea. On some of the shores of Ireland, particularly those of Galway and Waterford, these fish are very abundant. They are also caught in

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jaw is longer than the upper one. There are two dorsal fins, the second of which extends nearly to the tail. The mouth is very wide, and armed with long and sharp teeth.

SYNONYMS. Gadus merluccius. *Linnæus.*—La Merluche. *La Cepede. Bloch.*

vast quantities near Penzance in Cornwall, and on some parts of the coast of Devonshire.

There are few animals more voracious than these. They pursue, with great eagerness, the shoals of herrings and mackrel; and, when other prey is not easily had, they will attack and devour even their own species.

Although the Hake is a fish much esteemed on various parts of the Continent, we have in England so many better kinds, that it is not much regarded. It is, however, dried and salted for exportation to Spain, Portugal, and the Mediterranean. The flesh is white, separates into flakes, but is generally soft, and not well tasted.

The liver of the Hake, which is large, and of a pale yellow colour, was, by the ancients, nearly as much esteemed as that of the mullet.

MAHARAJA SERFOGI'S SARASWATI MAHAL.

Thoracic Fish*.

OF THE SUCKING-FISH TRIBE.

The Sucking-fishes have a naked, flat, and oily head, surrounded by a narrow margin, and marked with several transverse streaks or grooves. They have also ten rays in their gill-membrane; and their body is destitute of scales.

There are only three known species: these are occasionally seen in the Mediterranean Sea, and the Pacific Ocean.

THE COMMON REMORA, OR SUCKING-FISH*.

From the time of Aristotle to the present day, this fish has been an object of constant attention and surprise. The ancient naturalists, not satisfied with imputing to it wonderful qualities, and very extraordinary powers, proceeded so far as even to regard its properties among what they denominated the occult qualities of nature. The Remora, in almost all ages, has ranked high in the writings of poets,

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* The fishes of the Linnean order *Thoracici*, have bony gills, and ventral fins before the pectoral ones.

† Description. This singular animal is usually about a foot in length, and has sixteen or more furrows on the top of the head. The back is convex and black, and the belly white. The tail is forked.

Synonyms. Echeneis remora. *Linn.*—La Remore, and Sucet, in France.

in the comparisons of orators, the narrations of travellers, and the descriptions of naturalists.

The ancients absurdly believed that, small as it is, it had the power of arresting the progress of a ship in its fastest sailing, by adhering to its bottom.

The sucking-fish beneath, with secret chains,
Clung to the keel, the swiftest ship detains.
The seamen run confus'd, no labour spar'd,
Let fly the sheets, and hoist the top-mast yard.
The master bids them give her all the sails,
To court the winds, and catch the coming gales.
But, though the canvass bellies with the blast,
And boisterous winds bend down the cracking mast,
The bark stands firmly rooted in the sea,
And will, unmov'd, nor winds nor waves obey;
Still, as when calms have flatted all the plain,
And infant waves scarce wrinkle on the main.
No ship in harbour moor'd so careless rides,
When ruffling waters tell the flowing tides.
Appall'd, the sailors stare, through strange surprise,
Believe they dream, and rub their waking eyes.
As when, unerring from the huntsman's bow,
The feather'd death arrests the flying doe,
Struck through, the dying beast falls sudden down,
The parts grow stiff, and all the motion's gone;
Such sudden force the floating captive binds,
Though beat by waves, and urged by driving winds.

It inhabits most parts of the ocean, and is often found so strongly adhering to the sides of sharks and other fish, by means of the process on the upper part of its head, as not to be separated without great difficulty. Five of them have been taken from the body of a single shark. St. Pierre says he has put some of them on an even surface of glass, from which he could not afterwards remove them.

The Indians of Jamaica and Cuba formerly used the Sucking-fish in the catching of others, somewhat in the

same manner as hawks are employed by a falconer in seizing birds. They kept them for the purpose, and had them regularly fed. The owner, on a calm morning, would carry one of them out to sea, secured to his canoe by a small but strong line, many fathoms in length; and the moment the creature saw a fish in the water, though at a great distance, it would dart away with the swiftness of an arrow, and soon fasten upon it. The Indian, in the mean time, loosened and let go the line, which was provided with a buoy that kept on the surface of the sea, and marked the course the Sucking-fish had taken; and he pursued it in his canoe, until he perceived his game to be nearly exhausted and run down.—He then, taking up the buoy, gradually drew the line towards the shore; the Sucking-fish still adhering with so inflexible a tenacity to his prey as not easily to be removed. Oviedo says he has known turtle to be taken by this mode, of a bulk and weight that no single man could support.

These fish are often eaten, and in taste they are said somewhat to resemble fried artichokes.

OF THE DORÉE TRIBE.

None of the fishes of the present tribe were known to the ancient naturalists, except the Common Dorée. There are about eight species, some of which are found in the European, and others in the American seas. One of the species*, which inhabits the fresh waters of India, like the Beaked Chætodon †, swims near the surface, and catches aquatic insects, by jetting water upon them from its mouth. Their wings are by this means wetted, and they become an easy prey.

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* *Zeus insidiator* of Linnæus.

† *Chætodon jaculator* of Linnæus.

THE COMMON OR JOHN DOREE.

The ancients were well acquainted with the John Dorée: it is expressly mentioned in the writings both of Ovid and Pliny. This fish, and not the haddock, is, by many persons, supposed to have been the same out of the mouth of which the Apostle Peter, at the command of our Saviour, took the tribute-money. The indication of this is stated to be a dark spot, somewhat like a finger-mark, on each side of the head. Hence it is called, on the French coasts of the Mediterranean, *le poisson de Saint Pierre;* on the Italian coasts, *Pesce San Piedro;* and in Germany, *St. Peter-fisch.* By the modern Greeks it is denominated the *fish of St. Christopher,* from one of their pious legends relative to that saint.

The Dorée is a very voracious animal, feeding on various species of small fish, which it pursues with great rapacity. It will seize, and almost without discrimination, almost all kinds of baits. The audaciousness of the Dorée ought not to surprise us, when we consider that, independently of the enormous dimensions of its mouth, and the number and strength of its teeth, it has a longitudinal range of strong spines, not only on each side of the dorsal fins, but likewise from the mouth all the way to the second anal fin. These tend to protect it from injury by its enemies of the deep.

When the Dorée is taken alive out of the water, it is able to compress its internal organs so rapidly, that the air, in rushing through the openings of the gills, produces a kind of noise, somewhat like that which, on similar occasions, is emitted by the gurnards.

The Dorée is found in the North Sea, in the British Channel, the Mediterranean, and the Atlantic Ocean.

OF THE FLAT FISH IN GENERAL.

The present tribe comprehends those fish that are usually denominated Flat-fish; as the Turbot, Plaise, Flounder, Sole, &c. These are generally confined to the muddy or sandy banks of the sea, where they have the power of burying themselves as far as the head, for the purpose of escaping the devastations of the more rapacious tribes. They seldom rise far from the bottom, since, from the want of an air-bladder to buoy them up, which most of the other fishes possess, they are compelled to use their pectoral fins for this purpose, in somewhat the same manner as birds use their wings to rise in the air; and this is not done without considerable exertion. Here, therefore, they generally swim, with their bodies in an oblique position, and feed on such aquatic animals as come in their way.

Many of them, as the Holibut, Turbot, and some others, grow to a large size. The eyes of the whole tribe are situated on one side of the head. It is a curious circumstance, that, while the under parts of their body are of a brilliant white, the upper parts are so coloured and speckled as, when they are half immersed in the sand or mud, to render them almost imperceptible. Of this resemblance they are so conscious, that whenever they find themselves in danger, they sink into the mud, and there continue perfectly motionless. This is a circumstance so well known to fishermen, that within their palings on the strand they are often under the necessity of tracing furrows with a kind of iron sickle, in order to detect by the touch, what they are not otherwise able to distinguish. Not being rapacious, or furnished with any weapons of defence, these fishes owe their security to this stratagem; while the thornback and rays, which are carnivorous, and armed with strong spines, although flat-fish of a different class, are marbled with

lighter colours, that they may be perceived and avoided by less powerful fish.

THE TURBOT *, AND HOLIBUT †.

The northern parts of the English coast, and some places off the coast of Holland, afford Turbots in greater abundance, and in greater excellence, than any other parts of the world. Lying here, however, in deep waters, they are seldom to be caught but by lines.

In fishing for Turbot off the Yorkshire coast, three men go out in each of the boats, each man provided with three lines, every one of which is furnished with two hundred and eighty hooks, placed exactly six feet two inches asunder. These are coiled on an oblong piece of wicker-work, with the hooks baited and placed very regularly in the centre of the coil. When they are used, the nine are generally fastened together so as to form one line with above two thousand hooks, and extending nearly three miles in length. This is always laid across the current. An anchor and buoy are fixed at the end of each man's line. The

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* Description. Turbots have sometimes been known to weigh from twenty-five to thirty pounds. Their general form is somewhat square. The upper parts of the body and fins are cinereous, with dark spots; and the under parts white. On the upper parts there are numerous short and blunt spines. The eyes are on the left side of the head.

Synonyms. Pleuronectus maximus. *Linn.*—Le Turbot. *La Cepede.*—Bret, in some counties of England.—Gunner flook, in Scotland.

† Description. The Holibut has been known to attain so great a weight as between two and three hundred pounds. Its general shape is long and narrow. The upper parts are dusky, and the under parts white. The skin is smooth, and destitute of spines. The eyes are on the right side of the head.

Synonyms. Pleuronectes hippoglossus. *Linn.*—Le Flétan. *La Cepede.*—Turbot flook, in Scotland.

tides run here so rapidly, that the fishermen can only shoot and haul their lines in the still water at the turn of the tide; and therefore, as it is flood and ebb about every alternate six hours, this is the longest time the lines can remain on the ground. When the lines are laid, two of the men usually wrap themselves in the sail and sleep, whilst the third is on watch to prevent their being run down by ships, and to observe the weather.

The boats used in this work are each about a ton burthen; somewhat more than twenty feet in length, and about five in width. They are well constructed for encountering a boisterous sea, and have three pairs of oars, and a sail, to be used as occasion requires. Sometimes larger boats than these are used, which carry six men and a boy. When the latter come to the fishing-ground, they put out two of the smaller boats that they have on board, which fish in the same manner as the three-manned boats do, save that each man is provided with a double quantity of lines; and, instead of waiting in these the return of the tide, they return to the large boat and bait their other lines: thus hauling one set and shooting another, at every turn of the tide. The fishermen commonly run into harbour twice a week, to deliver their fish.

The bait that the Turbots take most readily is fresh herring, cut into proper-sized pieces: they are also partial to the smaller lampreys, pieces of haddock, sand-worms, muscles, and limpets; and when none of these are to be had, the fishermen use bullock's liver. The hooks are two inches and a half long in the shank, and nearly an inch wide betwixt the shank and the point. They are fastened to the lines upon sneads of twisted horse-hair, twenty-seven inches in length. The line is made of small cording, and is always tanned before it is used.

The voracity of these fish in pursuit of prey is oftentimes such, that it carries them into the mouths of rivers, or the entrance of ponds in salt-marshes, which communicate

with the sea. But they are not contented with merely employing agility and strength in the procuring of their food, they likewise have recourse to stratagem. They plunge themselves into the mud or sand at the bottom of the sea, and cover their whole body, except their eyes and mouth. Thus concealed, they seize upon, and devour all the smaller kinds of fish which incautiously approach them. It is said that they are very particular in the choice of their food, refusing, invariably, all except living animals, or such as are not in the least degree putrid. And the fishermen assert, that they are never to be caught with baits which have been bitten by other fish.

In many parts of this country, Turbot and Holibut are sold indiscriminately for each other. They are, however, perfectly distinct, the upper parts of the former being marked with large, unequal, and obtuse tubercles; while those of the other are quite smooth, and covered with oblong soft scales that adhere firmly to the body. The eyes of the Turbot also are on the left, whilst those of the Holibut are on the right of the head.

Holibuts are sometimes caught of such immense size on the northern coasts of England, as to weigh from two to three hundred pounds. Olafsen speaks of having seen one in Iceland, which measured five ells in length.

They are generally taken with hooks and lines. The Greenlanders employ the membrane of the stomach of the Holibut, in place of glass for their windows. The Swedes and Icelanders make of these fish what they call *raff* and *ræchel:* the first consists of the fins, with the fat skin to which they are attached; and the latter, of pieces of the flesh cut into stripes. Holibuts, also, are salted in the manner of herrings, which is said to be the best mode of curing them.

These fish spawn in the spring of the year, depositing their ova, which are of a pale red colour, on the shore amongst the rocks and stones.

THE SOLE *.

In the economy of the soles, we have an account of one circumstance which is very remarkable: among various other marine productions, they have been known to feed on shell-fish, although they are furnished with no apparatus whatever in their mouth for reducing them to a state calculated for digestion. Some soles that were purchased by Mr. Collinson, had their bellies hard and prominent, appearing to be filled with rows of some hard substance, which, on being opened, were found to be shell-fish. These, from the bulging of the shells, and the intervening interstices, gave the intestines somewhat the appearance of strings of beads. On further examination, some of them were found nearly dissolved, others partly so, but many of them whole. The most usual food of the Soles is the spawn and young of other fish.

Soles are found on all the British coasts; but those of the western shores are much superior in size to what are taken in the north; they are sometimes found of the weight of six or seven pounds. The principal fishery for them is in Torbay.

These fish are in great request for the tables of the opulent, their flesh being more tender and much more generally esteemed, than that either of the plaise or flounder. It has also the peculiar quality of keeping for several days, even in hot weather, without becoming tainted; and indeed it acquires a more delicate flavour by being thus kept. On this account it is, that Soles, in the London markets, are frequently much more esteemed than those which are cooked immediately after they are taken out of the sea.

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* Synonyms. Pleuronectes Solea. *Linn.*—La Sole and Perdix de Mer, in France.

During the winter season these fish usually retire into the deep water; but at the approach of spring they frequent the sea shores, and the mouths of rivers. They are usually caught either in trawl nets on the sand-banks out at sea, or with seine nets on the shore.

THE PLAISE* AND FLOUNDER†.

The general habits both of the Plaise and the Flounder, resemble those of all the other flat-fish. They are each found in great abundance in most of the European seas. Flounders oftentimes ascend rivers, and occasionally even so far, as to be beyond the immediate influence of the tides.

The Plaise spawns in the month of February or March, the ova being deposited among the rocks and marine plants. It is generally caught in the same manner as the sole.

These are firm and well-flavoured fish, but they vary much in this respect. The small and thin ones are generally inferior to the others, because their flesh becomes soft and gluey in boiling. They are of a bluish white colour on the under side of their body, whilst those which are in greatest perfection, have a fine reddish tinge on this part. In some countries the worst sort are salted, dried in the air, and afterwards packed for sale. The larger and better kinds are also dried, and when the skin is taken off, it is said that they may be cut and eaten in the manner of cheese.

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* DESCRIPTION. The principal distinction between the Plaise and the Flounder, consists in the former having a row of six tubercles behind the left eye, of which the latter is entirely destitute.

SYNONYMS. Pleuronectes platessa. *Linn.*—La Plie. *La Cepede.*—Pless, in Scotland.

* SYNONYMS. Pleuronectes flesus. *Linn.*—Le Flez. *La Cepede.*—Fluke or But, in some parts of England.—Mayoch flook, in Scotland.

The best season for *Flounders* is considered to be from the spring to the autumn. Their quality depends much on the place where they are caught, and the quantity and description of food which they are able to obtain. Those that inhabit the fresh waters, are generally considered the best. In rivers they are most commonly found where the bottom is sandy or muddy. In shallow waters, when they are disturbed, they dart swiftly along the bottom, to the distance of a yard or two, into concealment; and their track is distinctly to be traced by the cloud of mud or sand which they throw up in their progress.

OF THE CHÆTODON TRIBE.

In this tribe, although the species are very numerous, there is only one of which I have met with any account in the least degree interesting.

The head and mouth of the Chætodons are small, and they have the power of pushing out and retracting the lips, so as to make a tubular orifice. The teeth are mostly bristle-shaped, flexile, moveable, closely set, and very numerous. The gill-membrane has from three to six rays. The body is scaly, broad, and compressed; and the dorsal and anal fins are generally terminated with prickles.

THE BEAKED CHÆTODON*.

The Beaked Chætodon or Shooting-fish frequents the shores and mouths of rivers in India, and about the Indian islands. It is somewhat more than six inches in length.

This fish feeds principally on flies and other small winged insects that hover about the waters it inhabits;

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* Description. This fish is of a whitish or very pale brown colour, with commonly four or five blackish bands running across

and the mode of taking its prey is very remarkable. When it sees a fly at a distance on any of the plants in the shallow water, it approaches very slowly, and with the utmost caution, coming as much as possible perpendicularly under the object. Then, putting its body in an oblique direction, with the mouth and eyes near the surface, it remains for a moment immoveable. Having fixed its eyes directly on the insect, it shoots at it a drop of water from its tubular snout, but without showing its mouth above the surface, from whence only the drop seems to rise. This is done with so much dexterity, that though at the distance of four, five, or six feet, it seldom fails to bring the fly into the water. With the closest attention the mouth could never be discovered above the surface, although the fish has been seen to eject several drops one after another, without leaving the place, or in the smallest apparent degree, moving its body.

This very singular action was reported to M. Hommel, the governor of the hospital at Batavia, near which place the species is sometimes found; and so far raised his curiosity, that he was determined, if possible, to convince himself of its truth, by ocular demonstration.

For this purpose, he ordered a large, wide tub to be filled with sea water; he then had some of these fish caught and put into it; and the water was changed every other day. After a while, they seemed reconciled to their confinement; and he then tried the experiment. A slender stick, with a fly fastened at the end, was placed in such a

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the body, which is ovate and compressed. The snout is lengthened and cylindrical. The dorsal and anal fins are very large, and on the former there is a large eye-like spot.

SYNONYMS. Chætodon rostratus. *Linn.*—Chætodon enceladus. *Shaw.*—Jaculator or Shooting-fish. *Phil. Tran.*—Beaked Chætodon. *Shaw.*—La Boudoulière à bec, by the French.

manner on the side of the vessel, as to enable the fish to strike it; and it was not without inexpressible delight, that he daily saw them exercising their skill in shooting at it with amazing force, and seldom missing their mark.

The flesh of this species is white and well tasted.

*OF THE PERCH TRIBE**.

Out of about sixty known species of Perch, the ancients were acquainted only with three. There are about five which are natives of the British rivers and sea-coasts. The voracity of these fish is boundless. They are also endowed with strong muscular powers of action, and with great activity of body. When seized in the hand, or attacked by an enemy, they erect the spines of their first dorsal fin, and strike them at the intruder with such force and address, as sometimes to cause dreadful lacerations.

THE COMMON PERCH †.

The Common Perch are gregarious; and, contrary to the nature of nearly all fresh-water fish that swim in shoals, they are so voracious as to attack and devour even their own species. They grow slowly, and are seldom caught of extraordinary size. The largest that was ever heard of in this country, was caught some years ago in

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* All the species of Perch have jaws that are unequal in length, armed with sharp-pointed and incurved teeth. The gill-membrane has seven rays; and its cover consists of three plates, the uppermost of which is serrated. The scales that cover the body are hard and rough. The first dorsal fin is spinous, and the second (except in one species) is soft.

† SYNONYMS. Perca fluviatilis. *Linn.*—La Perche. *La Cepede.*—Perch. *Will.*—*Penn. Brit. Zool. vol.* iii. *tab.* 48.

the Serpentine River in Hyde Park: it weighed nine pounds. The usual weight is not, however, more than from half a pound to two pounds.

They are found in clear, swift rivers with pebbly or gravelly bottoms, and in those of a sandy or clayey soil. They seem to prefer moderately deep water, and holes by the sides of, or near to gentle streams, where there is an eddy; the hollows under banks, among weeds, and roots of trees; the piles of bridges or ditches, and back streams that have a communication with some river. They will also thrive fast in ponds that are fed by a brook or rivulet.

Perch are very tenacious of life. They have been known to survive a journey of nearly sixty miles, although packed in dry straw.

It is generally believed that the pike will not attack a full-grown Perch, on account of the spiny fins on its back, which this fish always erects on the approach of an enemy. The smaller Perch, however, are frequently used as bait for the pike.

The season of angling for Perch, is from April to January; and the time from sunrise till ten o'clock, and from two o'clock till sunset: except in cloudy weather, with a ruffling south wind, when they will bite all day. The baits are various kinds of worms, a minnow, or grasshopper.—So voracious are these fish, that, it is said, if an expert angler finds a shoal of them, he is sure of taking every one. If, however, a single fish escapes that has felt the hook, all is over; this fish becomes so restless, as soon to occasion the whole shoal to leave the place.

In winter the Perch is exceedingly abstemious, and during that season scarcely ever bites, except in the middle of a warm sun-shiny day.—In clear weather in the spring, sometimes a dozen or more of these fish may be observed in a deep hole, sheltered by trees and bushes. The angler may then observe them striving which shall first seize his bait, till the whole shoal are caught.

The females deposit their spawn, sometimes to the amount 280,000 ova, betwixt the months of February and May. This is usually done during the act of rubbing themselves against some sharp body.

Perch are much admired as firm and delicate fish. They were in high esteem among the Romans.

In one of the pools of Merionethshire there is a singular *variety* of the Perch, the back of which is hunched, and the lower part of the back-bone next the tail is strangely distorted. The common kind are as numerous in this pool as the deformed fish. Some of the crooked Perch have likewise been found in the small alpine lakes of Sweden.

OF THE STICKLEBACKS IN GENERAL.*

The species, which are not very numerous, are dispersed over various parts of the world, some inhabiting the fresh waters, and others being confined to the ocean. The manners of the former may in a great measure be collected from those of the following species:

THE THREE-SPINED STICKLEBACK †.

These little fish, which seldom exceed two inches in length, are very common in many of our rivers. They have three sharp spines on their back, which are their

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* In the Sticklebacks the head is somewhat oblong and smooth, having the jaws armed with minute teeth. The gill-membrane has either three, six, or seven rays. The body is keel-shaped towards the tail, and covered with bony plates. On the back, betwixt the dorsal fin and the head, are several sharp spines.

† SYNONYMS. Gasterosteus aculeatus. *Linn.*—Stickleback, Bansticle, Sharpling. *Willughby's Ich.*—Prickle-back, Prickle-bag. *Phil. Tran.—Penn. Brit. Zool. vol.* iii. *tab.* 50.

instruments both of offence and defence, and are always erected on the least appearance of danger, or whenever they are about to attack other fish. The body near the tail is somewhat square, and the sides are covered with transverse bony plates. Their usual colours are olive green above, and white on the under parts; but in some individuals the lower jaw and the belly are of a bright crimson.

By feeding with great voracity on the fry and spawn of other fish, they are, notwithstanding the smallness of their size, greatly detrimental to the increase of almost all the species among which they inhabit. One that Mr. Arderon of Norwich had in a glass, devoured in five hours no fewer than seventy-four young dace, each about an inch and a half long, and of the thickness of a horse-hair, and would have done the same every day, had they been given to it.

The fish was put by Mr. Arderon into a glass jar of water, with some sand at the bottom, for the purpose of trying some experiments on it, as well as for the purpose of ascertaining its manners, as far as possible, in a confined state. For a few days it refused to eat; but by frequently giving it fresh water, and by coming often to it, it began to eat the small worms that were now and then thrown into the jar; soon afterwards it became so familiar as to take them from the hand; and at last it even became so bold, as, when it was satiated, or did not like what was offered to it, to set up its prickles, and strike with its utmost strength at the fingers, if put into the water to it. It would suffer no other fish to live in the same jar, attacking whatever were put in, though ten times its own size. One day, by way of diversion, a small fish was put to it. The Prickleback immediately assaulted and put it to flight, tearing off part of its tail in the conflict; and had they not been then separated, he would undoubtedly have killed it.

Small as these animals are, they are sometimes so numerous, as to be obliged to colonize, and leave their native places in search of new habitations. Once in every seven or eight years they appear in the river Welland, near Spalding in Lincolnshire, in such amazing shoals, as, during their progress up the stream, to appear in a vast body, occupying the whole width of the river. These are supposed to be the overplus of multitudes collected in some of the fens. When this happens, they are taken as manure for the land; and an idea may be formed of their numbers, from the circumstance that a man, employed by a farmer to catch them, got, for some time, four shillings a day by selling them at a halfpenny a bushel.

The great exertions they use, in getting from one place to another, where obstacles intervene, are very extraordinary; for, though the largest among them is seldom known to be more than two inches in length, they have been seen to spring a foot and a half, (nine times their own length,) in perpendicular height from the surface of the water, and in an oblique direction much further.

They spawn in April and June, on the aquatic plants; and are very short-lived, scarcely ever attaining the third year. They are too small, and perhaps too bony, to be of any essential service as food to mankind; but in some parts of the Continent they are of considerable use in fattening ducks and pigs.

OF THE MACKREL TRIBE.*

Nearly all the species of Mackrel are gregarious, and unite in immense shoals. Some of them are migratory,

* The fish which constitute the present tribe have a smooth body, and seven rays in their gill-membrane. Between the dorsal fin and the tail, there are several small or spurious fins.

making long voyages at certain seasons of the year. It is believed that they are all eatable; and some of them are well known to be exceedingly delicate food. They afford employment and support to numerous fishermen in various countries of Europe. There are in the whole about twenty-five species, of which four are found on the British coasts.

THE COMMON MACKREL*.

The Mackrel, when alive, from the elegance of its shape, and the brilliancy of its colours, is one of the most beautiful fish that frequents our coasts. Death, in some measure, impairs the colours, but it by no means obliterates them.

It visits our shores in vast shoals; but, from being very tender and unfit for long carriage, is found less useful than other gregarious fish. In some places it is taken by lines from boats, as during a fresh gale of wind it readily seizes a bait. It is necessary that the boat should be in motion in order to drag the bait along (a bit of red cloth or a piece of the tail of a Mackrel,) near the surface of the water. The great fishery for Mackrel is on some parts of the west coast of England. This is of such an extent as to employ, in the whole, a capital of nearly 200,000*l*. The fishermen go out to the distance of several leagues from the shore, and stretch their nets, which are sometimes several miles in extent, across the tide, during the night. The meshes of these nets are just large enough to admit the heads of tolerably large fish, and catch them by the gills. A single boat has been known to bring in, after one night's fishing, a cargo that has sold for nearly seventy pounds.—Besides these, there is another mode of fishing for Mackrel, in the

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* SYNONYMS. Scomber scomber. *Linn.*—Mackrell, or Mackarel. *Will. Ich*—*Penn. Brit. Zool. vol.* iii. *tab.* 51.—Le Maquereau, by the French.

west of England, with a *ground seine.* A roll of rope, of about two hundred fathoms in length, with the net fastened to the end, is tied, at the other, to a post or rock, on the shore. The boat is then rowed to the extremity of this coil, when a pole fixed there, leaded heavily at the bottom, is thrown overboard. The rowers from hence make as nearly as possible a semicircle, two men continually and regularly putting the net into the water.—When they come to the other end of the net, where there is another leaded pole, they throw that overboard. Another coil of rope, similar to the first, is by degrees thrown into the water, as the boatmen make for the shore. The boat's crew now land, and, with the assistance of persons stationed there, haul in each end of the net till they come to the two poles. The boat is then again pushed off towards the centre of the net, in order to prevent the more vigorous fish from leaping over the corks. By these means, three or four hundred fish are often caught at one haul.

Mackrel are said to be fond of human flesh. Pontoppidan informs us that a sailor, belonging to a ship lying in one of the harbours on the coast of Norway, went into the water to wash himself; when he was suddenly missed by his companions. In the course of a few minutes, however, he was seen on the surface with vast numbers of these fish fastened on him. The people went in a boat to his assistance: and though, when they got him up, they forced with some difficulty the fishes from him, they found it was too late; for the poor fellow, very shortly afterwards, expired.

The roes of the Mackrel are used in the Mediterranean for *caviar.* The blood and slime are first washed off with vinegar, and the sinews and skinny parts taken away. They are then spread out for a short time to dry, and afterwards salted and hung up in a net, to drain some of the remaining moisture from them. When this is finished they are laid in a kind of sieve, until thoroughly dry and fit for

use. In Cornwall, and on several parts of the Continent, the Mackrel are preserved by means of pickling and salting. Their greatest weight seldom exceeds two pounds, though some have been seen that weighed more than five. Their voracity has scarcely any bounds; and when they get among a shoal of herrings, they make such havock as frequently to drive it away. They are very prolific, and deposit their spawn among the rocks near the shore, about the month of June. They die almost immediately after they are taken out of the water, and for a short time exhibit a phosphoric light.

In spring their eyes are covered with a white film, that grows in the winter, and is regularly cast at the beginning of summer. During this time they are said to be nearly blind.

The celebrated *garum* of the Romans, was a pickle prepared from this fish.

THE THUNNY *.

On the coasts of Sicily, as well as in several other parts of the Mediterranean, there are very considerable Thunny fisheries. The nets are spread over a large space of sea by means of cables fastened to anchors, and are divided into

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* Description. These fish are from two to ten feet in length. The body is round and thick, and tapers nearly to a point both at the head and tail. The skin of the back is very thick and black, and that of the sides and belly silvery, tinged with light blue and pale purple. The tail is crescent-shaped, with the tips far asunder; and the spurious fins between the dorsal fin and the tail (which mark the species) are from eight to eleven in number.

Synonyms. Scomber Thynnus. *Linn.*—Albicore. *Var.*—Mackrel-sture, or Great-Mackrel, in Scotland.—Tunny Fish, or Spanish Mackrel. *Will. Ich.*—*Penn. Brit. Zool. vol.* iii. *tab.* 52.—Le Thon, in France.

several compartments. A man, placed upon the summit of a rock high above the water, gives the signal of the fish being arrived; for he can discern from that elevation what passes under the water, much better than any person near the surface. As soon as notice is given that a shoal of fish has penetrated as far as the inner compartment of the net, the passage is drawn close, and the slaughter begins.

The Thunnies enter the Mediterranean about the vernal equinox, travelling in a triangular phalanx, so as to cut the waters with its point, and to present an extensive base for the tides and currrents to act against, and impel forwards.

They repair to the warm seas of Greece to spawn, steering their course thither along the European shores; but as they return they approach the African coast: the young fry is placed in the van of the squadron as they travel. They come back from the East in May, and abound about that time on the coasts of Sicily and Calabria. In autumn they steer northward, and frequent the neighbourhood of Amalphi and Naples. They are not uncommon on the western coasts of Scotland, where they come in pursuit of the herrings, and often during the night strike into the nets and do considerable damage. When the fishermen draw these up in the morning, the Thunny rises at the same time towards the surface, ready to catch the fish that drop out. On its being observed, a line is thrown into the water, having a strong hook baited with a herring, which it seldom fails to seize. As soon as the fish finds itself ensnared, it seems to lose all its active powers, and, after very little resistance, submits to its fate.

The quantity of these fish that is annually consumed in the two Sicilies, almost exceeds the bounds of calculation. When taken in May they are full of spawn, and are then esteemed unwholesome, as being apt to occasion headachs and vapours: to prevent, in some measure, these bad effects,

the natives fry them in oil, and afterwards salt them. The pieces, when fresh, appear exactly like raw beef; but when boiled they turn pale, and have somewhat the flavour of salmon. The most delicate parts are those about the muzzle. Those fish which the inhabitants are not able to use immediately, are cut into slices, salted, and preserved in large tubs, either for sale or winter provisions.

The Thunny was a fish so well known to the ancients, as to form a principal article of their commerce. By the Romans it was held in great estimation.

*OF THE SURMULLETS IN GENERAL**.

By the ancient Greeks and Romans, Surmullets were held in the highest esteem, for the tables of the rich and the luxurious. Pliny was acquainted with two species; and the principal distinction of habit that he has mentioned is, that one of them subsists on living animals, and the other on marine plants. This distinction is, however, by no means correct, since not only the mouth, but also the digestive organs, are precisely the same in each; consequently, their food is necessarily the same also.

There are several species, of which two only are British. They feed on other fish, on testaceous animals, crabs, and putrid bodies which they find floating in the ocean. None of them are known to inhabit the fresh waters.

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* The head of these fishes is compressed, sloping, and covered with scales. The eyes are oblong, approximate, and vertical. The jaws and palate are armed with small teeth. The gill-membrane has three rays. The body is round, long, and covered with large scales, which easily drop off.

THE RED SURMULLET *.

There are few fish which have attained greater celebrity for beauty of appearance, or as constituting a delicious food, than these. From the enormous price at which they were sold amongst the ancient Romans, it should seem that, at this period, they could only be procured by the most wealthy of the inhabitants. Pliny assures us, that one of the Roman consuls paid for a single Surmullet, a sum equal to nearly sixty-five pounds of our money; and, according to Suetonius, one of the emperors purchased three of them for 30,000 sesterces, or about two hundred and forty-two pounds. To such an absurdity of luxury and ostentation did the Romans arrive, previously to the dissolution of their empire.

At Constantinople the markets are generally well supplied with these fish, which are very common both in the Bosphorus and Black Sea. In the Crimea, they are so much esteemed as to have the name of *Sultan balik*, or Sultan fish.

Ths Red Surmullet is a predatory and voracious fish, feeding, with great eagerness, on marine crustaceous animals. It frequents the sea coasts more than the open sea, and generally swims in extensive shoals.

Its flesh is white, firm, well tasted, and, as it is stated,

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* DESCRIPTION. This fish seldom exceeds the length of eight or nine inches. The head is large, broad, and compressed at the sides, having two cirri, or beards, near the extremity of the lower jaw. The body is thick in its fore part, compressed, and covered with large scales. The back and the sides are red; the belly silvery, and the fins yellow.

SYNONYMS. Mullus barbatus. *Linn.*—Le Rouget. *La Cepede.*—Barbet, and Petit Surmullet, in France.

peculiarly easy of digestion. The parts principally in esteem with the ancients, were the head and the liver.

In most of their habits, the *Striped Surmullets* resemble the last species. They usually swim in vast shoals; and, in the spring of the year, deposit their eggs at the bottom of the sea, near the mouths of great rivers. By the ancients they were supposed to spawn three times in the year.

Their flesh is firm and excellent. They are caught in several ways, by means of nets, osier baskets, and lines baited with pieces of lobster or crab. As the flesh soon putrifies, these fish, in many countries, are boiled in salt water immediately after they are caught: they are then dredged thickly over with flour, and enclosed in a paste, for the purpose of preventing the bad effects of contact with the air.

OF THE GURNARDS IN GENERAL.*

These are amongst the carnivorous and predatory tribes of fish. They inhabit not only the North Sea and the Baltic, but are also found in the Mediterranean, and in various parts of the ocean. When taken alive out of the water, they erect their sharp dorsal fin, and attempt to inflict a wound by means of its spines. This is their weapon of defence against their enemies of the ocean. When taken up, they also compress their bellies, and, in expelling the air from thence, make a singular kind of noise: hence the French have given to them the general appellation of *Grondins*, or grumblers.

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* In the Gurnards the head is large, and covered with strong bony plates. The eyes are large, round, and vertical. The mouth is large; and the palate and jaws are armed with sharp teeth. The gill-membrane has seven rays. The back has a longitudinal, spinous

THE GRAY GURNARD*, AND RED GURNARD†.

About the months of May and June the Gray Gurnards approach the sea shores in considerable shoals, for the purpose of depositing their spawn upon the shallows. They are occasionally found on most of the shores of Great Britain and Ireland.

They chiefly reside in the depths of the ocean, where they have a plentiful supply of food in crabs, lobsters, and shell-fish, on which it is supposed they, for the most part, feed.

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groove on each side. There are slender, articulate appendages at the base of each pectoral fin.

* DESCRIPTION. The Red Gurnard usually measures from one to two feet in length. The extremity of the head in front is armed on each side with three short spines. The forehead and covers of the gills are silvery; and the latter finely radiated. At the end of each gill-cover there is a strong, sharp, and long spine; and beneath that, and just above the pectoral fins, another. The body is covered with small scales; the upper parts are of a deep gray, spotted with white and yellow, and sometimes with black; and the lower parts silvery. The lateral line, which is composed of large and rough scales, is black in the middle and white at the edges.

SYNONYMS. Trigla gurnardus. *Linn.*—La Trigle gurneau. *La Cepede.*—Crooner, in Scotland.—Knoud, in Ireland.

† DESCRIPTION. On each side of the nose there are two short spines; and the spines on the gill-covers are longer and more slender than in the last species. The general colour of the body is red; and the pectoral fins are edged with purple. The lateral line is silvery, bordered with black, and much narrower, in proportion, than in the Gray Gurnard.

SYNONYMS. Trigla cuculus. *Linn.*—La Trigle grondin. *La Cepede.*—Le Rouget, ou Rouget Grondin. *Bloch.*—Bellicant gourneau, in France.—Gowrie, in Scotland.—Rocket, in some parts of England.

Their flesh is firm, white, and good, though many persons consider it somewhat insipid. They are easily caught by means of lines, baited with a piece of a fish, or a bit of red cloth; but the most general mode in which they are taken, is with nets.

Whilst it is in the water, the colours of the *Red Gurnard* are, almost beyond conception, brilliant and beautiful, particularly in the broad glare of sun-shine, as they then vary, in the most pleasing manner, with every motion of the fish.

There are few of the residents of the ocean so voracious as this; since it devours, with eagerness, almost every thing eatable that comes in its way. Its habits are nearly similar to those of the last species; and it deposits its spawn about the same season, and in similar situations.

Its flesh is considered much more excellent than that of the Gray Gurnard, since it is more tender, and at the same time more firm. The season in which it is in greatest perfection, is from about the beginning of May until the end of July.

Abdominal Fish*.

OF THE SALMON TRIBE†.

Rapid and stony rivers, where the water is free from mud, are the favourite places of most of the Salmon tribe. Some of them do indeed inhabit the sea: but they come up the rivers for the purpose of depositing their spawn in the beds of gravel; and in this instinctive pursuit they are able to surmount wonderful obstacles that oppose their course. After spawning, they return to the sea lean and emaciated. The whole tribe is supposed to afford wholesome food for mankind.

THE COMMON SALMON ‡.

This fish seems confined, in a great measure, to the northern seas, being unknown in the Mediterranean, and in the waters of other warm climates. It lives in fresh as well as in salt waters, forcing itself in autumn up the rivers, sometimes for hundreds of miles, for the purpose of depositing its spawn. In these peregrinations it is that Salmon are caught in the great numbers that supply

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* The fishes of the Linnæan order *Abdominales,* have bony gills, and ventral fins placed behind the thorax.

† These fish are distinguished from all others, by having two dorsal fins, of which the hindermost is fleshy and without rays. They have teeth both in the jaws and on the tongue; and the body is covered with round and minutely striated scales.

‡ SYNONYMS. Salmo Salar. *Linn.*—Le Saumon, by the French.

our markets and tables. Intent only on the object of their journey, they spring up cataracts, and over other obstacles of very great height. This extraordinary power seems to be owing to a sudden jerk which the fish gives to its body, from a bent into a straight position. When they are unexpectedly obstructed in their progress, it is said they swim a few paces back, survey the object for some minutes motionless, retreat, and return again to the charge; then, collecting all their force, with one astonishing spring overleap every obstacle. Where the water is low, or sand-banks intervene, they throw themselves on one side, and in that position soon work themselves over into the deep water beyond. On the river Liffey, in Ireland, there is a cataract about nineteen feet high: here, in the Salmon season, many of the inhabitants amuse themselves in observing the fish leap up the torrent. They frequently fall back many times before they surmount it; and baskets, made of twigs, are placed near the edge of the stream, to catch them in their fall.—At the falls of Kilmorack, in Scotland, where the Salmon are very numerous, it is a common practice with the country people to lay branches of trees on the edges of the rocks, and by this means they often take such of the fish as miss their leap, which the foaming of the torrent not unfrequently causes them to do. And the late Lord Lovat, who often visited these falls, taking the hint from this circumstance, formed a determination to try a whimsical experiment on the same principle. Alongside one of the falls he ordered a kettle full of water to be placed over a fire; and many minutes had not elapsed before a large Salmon made a false leap, and fell into it. This may seem incredible to those who never saw one of these rude salmon-leaps: but surely there is as great a chance of a Salmon falling into a kettle, as on any given part of the adjacent rock; and it is a thing that would certainly take place

many times in the course of the season, were but the experiment tried.

When the Salmon have arrived at a proper place for spawning in, the male and female unite in forming, in the sand or gravel, a proper receptacle for their ova, about eighteen inches deep, which they are also supposed afterwards to cover up. In this hole the ova lie until the ensuing spring, (if not displaced by the floods,) before they are hatched. The parents, however, immediately after their spawning, and extremely emaciated, hasten to the salt water. Toward the end of March the young fry begin to appear; and, gradually increasing in size, become, in the beginning of May, five or six inches in length, when they are called *Salmon-smelts.* They now swarm, in myriads, in the rivers; but the first flood sweeps them down into the sea, scarcely leaving any behind. About the middle of June the largest of these begin to return into the rivers: they are now become of the length of twelve or sixteen inches. Towards the end of July they are called *Gilse*, and weigh from six to nine pounds each.

When Salmon enter the fresh waters, they are always more or less infested with a kind of insect called the salmon-louse*: when these are numerous, the fish are esteemed in high season. Very soon after the Salmon have left the sea, the insects die and drop off.

After the fish have become lean at the spawning-time, on their return to the sea they acquire their proper bulk in a very little while; having been known to considerably more than double their weight in six weeks.—Their food consists of the smaller fishes, insects, and worms; for all these are used with success as baits, by the anglers for Salmon.

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* *Lernæa salmonea* of Linnæus.

The principal fisheries in Europe are in the rivers; or on the sea-coasts adjoining to the large rivers of England, Scotland, and Ireland. The chief English rivers for them are the Tyne, the Trent, the Severn, and the Thames. They are sometimes taken in nets; and sometimes by means of locks or weirs, with iron or wooden grates, so placed in an angle, that, being impelled by any force in a direction contrary to that of the stream, they open, let the fish (or whatever else pushes against them) through, and again, by the force of the water or their own weight, close and prevent their return. Salmon are also killed in still water, by means of a spear with several prongs, which the fishermen use with surprising dexterity. When this is used in the night, a candle and lantern, or a whisp of straw set on fire, is carried along, to the light of which the fish collect.

In the river Tweed, about the month of July, the capture of Salmon is astonishing: often a boat-load, and sometimes nearly two, may be taken at a tide; and, in one instance, above seven hundred fish were caught at a single haul of the net. From fifty to a hundred at a haul are very common. Most of those that are taken before the setting-in of the warm weather, are sent fresh to London, if the weather will permit. The others are salted, pickled, or dried, and are sent off in barrels, in quantities sufficient not only to stock the London markets, but also some of the markets of the Continent; for the former are by no means able to take all the fish that are caught here.

The season for fishing commences in the Tweed on the thirtieth of November, and ends about old Michaelmas day. On this river there are about forty considerable fisheries, which extend, upwards, about fourteen miles from the mouth; besides many others of less consequence. These, several years ago, were rented at above the annual sum of ten thousand pounds; and to defray this expense,

it has been calculated that more than 200,000 Salmon must be caught there, one year with another.

The Scotch fisheries are very productive; as are also several of those in Ireland, particularly that at Cranna on the river Ban, about a mile and a half from Coleraine. At this place, in the year 1760, as many as three hundred and twenty tons were taken.

A person of the name of Graham, who farmed the sea-coast fishery at Whitehaven, adopted a successful mode of taking Salmon, which he appropriately denominated *Salmon-hunting*. When the tide is out, and the fish are left in shallow waters, intercepted by sand-banks, near the mouth of a river, or when they are found in any inlets up the shore, where the water is not more than from one foot to four feet in any depth, the place where they lie is to be discovered by their agitation of the pool. This man, armed with a three-pointed barbed spear, with a shaft of fifteen feet in length, would mount his horse, and plunge at a swift trot, or moderate gallop, belly deep, into the water. He made ready his spear with both hands: when he overtook the Salmon, he let go one hand, and with the other struck the spear, with almost unerring aim, into the fish. This done, by a turn of the hand he raised the Salmon to the surface of the water, turned his horse's head to the shore, and ran the Salmon on dry land without dismounting. This man said, that by the present mode he could kill from forty to fifty in a day: ten were, however, no despicable day's work for a man and horse. His father was probably the first man that ever adopted this method of killing Salmon on horseback.

Salmon are cured by being split, rubbed with salt, and put in pickle, in tubs provided for the purpose, where they are kept about six weeks: they are then taken out, pressed, and packed in casks with layers of salt.

Different species of Salmon come in so great abundance

up the rivers of Kamtschatka, as to force the waters before them, and even to dam up the streams in such a manner as sometimes to make them overflow their banks. In this case, when the water finds a passage, such multitudes are left on the dry ground as would, were it not for the violent winds so prevalent in that country, assisted by the bears and dogs, soon produce a stench sufficiently great to cause a pestilence.

Salmon are said to have an aversion to any thing red, so that the fishermen are generally careful not to wear jackets or caps of that colour. Pontoppidan says also, that they have so great a dislike to carrion, that, if any happen to be thrown into the places where they are, they immediately forsake them.

THE SALMON OR SEA TROUT*.

Like the Salmon, this fish is an inhabitant of the sea, but in the months of November and December enters the rivers, in order to deposit its ova; and, consequently, during the spawning season, it is occasionally found in lakes and streams, at a great distance from the sea.

It feeds on aquatic insects, worms, and small fish, and is often caught by anglers, either with real or artificial flies. The fishing for Salmon-trout, with nets, generally commences towards the latter end of April, or the beginning of May; but they are considered in highest season about Michaelmas. So little tenacious are they of life, that they die almost as soon as they are taken out of the water.

The flesh of this Trout is red and very good, but, like that of the Salmon, the goodness varies according to the

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* SYNONYMS. Salmo trutta. *Linn.*—La Truite-saumone. *Bloch*—Truite de mer, in some parts of France.—Bull-trout, Scurf, and Budge, in some parts of England.

quality of the water in which they are caught. On this also depends the greater or less brilliancy and beauty of their colour. In muddy or putrid waters, they generally become insipid and unpalatable. They chiefly delight in large rivers, where the stream is rapid, and the bottom is either of sand or gravel.

In countries where they are caught in great quantities, these fish are cured in several ways, by pickling, salting, or smoking. And, thus preserved, they form a considerable branch of commerce. The mode of smoking them is as follows. The fishermen take a tub without bottom, and pierced all round the sides and at the top with holes. This they raise on three stones, and, suspending the Trouts in the interior, expose them, for three days, to the smoke of burning oak branches and juniper berries, which are lighted beneath them.

THE COMMON OR RIVER TROUT *.

Though this is certainly a very delicate and excellent fish for the table, it was in no esteem whatever among the ancients. It abounded in most of the lakes of the Roman empire, yet is only mentioned by writers on account of its beautiful colours.

In some rivers Trouts begin to spawn in October; but November is the chief month of spawning. About the end of September they quit the deep water, to which they had retired during the hot weather, and make great efforts to gain the course of the currents, seeking out a proper place for depositing their ova. This is always on a gravelly bottom, or where gravel and sand are mixed among

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* SYNONYMS. Salmo fario. *Linn.*—Salar of the ancient writers.—La Truite. *Bloch.*

stones, towards the end and sides of streams. At this period they turn black about the head and body, and become soft and unwholesome. They are never good when they are big with roe; which is contrary to the nature of most other fish. After spawning they become feeble, their bodies are wasted, and those beautiful spots, which before adorned them, are imperceptible. Their heads appear swelled, and their eyes are dull. In this state they seek still waters, and continue there sick, as it is supposed, all the winter. There are in all Trout rivers some barren female fish, which continue good through the winter.

In March, or sometimes earlier, if the weather be mild, the Trouts begin to leave their winter quarters, and approach the shallows and tails of streams, where they cleanse and restore themselves. As they acquire strength they advance still higher up the rivers, till they fix on their summer residence, for which they generally choose an eddy behind a stone, a log, or bank, that projects into the water, and against which the current drives. They also frequently get into the holes under roots of trees, or into deeps that are shaded by boughs and bushes.

These fish are said to be in season from March to September. They are, however, fatter from the middle to the end of August than at any other time.

Trouts in a good pond will grow faster than in some rivers. And a gentleman who kept them in ponds, for the purpose of ascertaining the progress and duration of their lives, asserts that at four or five years old they were at their full growth. For three years subsequent to this they continued with little alteration in size; two years after, the head appeared to be enlarged, and the body wasted, and in the following winter they died. According to this computation, nine or ten years seem to be the term of their existence.

In several of the northern rivers, Trouts are taken as red

and as well-tasted as charr; and their bones, when potted, dissolve like those of charr. These are often very large: one of them was caught some time ago, that measured twenty-eight inches in length.—A Trout was taken in the river Stour, in December 1797, which weighed twenty-six pounds, and another, some years ago, in Lough Neagh, in Ireland, that weighed thirty pounds.

This fish is not easily caught with a line, being at all times exceedingly circumspect. The baits used are worms or artificial flies. The season for fishing is from March till Michaelmas. The angler prefers cloudy weather, but he is not particular as to the time of day.

In two or three of the pools in North Wales, there is found a *variety* of the Trout which are naturally deformed, having a singular crookedness near the tail. Some of the perch in the same country have a similar deformity.—In two or three of the lakes of Ireland, there is another variety, called the *Gillaroo Trout*. The stomachs of these Trouts are so excessively thick and muscular, as to bear some resemblance to the organs in birds, called gizzards. These stomachs are sometimes served up to table as *Trouts' gizzards*. In the Common Trout the stomach is uncommonly strong and muscular; for, as well as small fish and aquatic insects, the animals live on the shell-fish of fresh-waters; and even take into their stomachs gravel or small stones, to assist in comminuting the testaceous part of their food.

THE SMELT*.

It is generally considered, that the smell of this elegant little fish somewhat resembles that of cucumbers newly

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* SYNONYMS. Salmo eperlanus. *Linnæus*.—L'Eperlan. *Bloch*.

cut. From its very peculiar scent, so unlike that of any other species of fish, we give to it the denomination of Smelt, or "smell it." The Germans call it *Stinckfisch*.

The best season for these fish is from December to May, about which time they approach the shores, and even ascend the rivers in immense shoals. Their usual season of spawning is about the months of March and April. In certain rivers the Smelts appear a long time before they spawn, and in others it has been remarked that they do not at all appear, so long as there is any snow-water floating down. After they have deposited their ova, they return to the sea, and are not again found in the rivers until the ensuing season. In the Thames they are caught in great abundance from November to January. They ascend the river Nyne in Northamptonshire, in the month of March, and have been caught there in great abundance, particularly above Allerton and Castor.

In many parts of Scotland, Smelts are taken by means of poke nets, tied between two poles, and anchored at the extremity. The ebbing of the tide forces the fish into them, and at low water the nets are taken up and emptied.

Smelts are found on the coasts of all the northern countries of Europe, and even in the Mediterranean. They vary considerably in size. Mr. Pennant states, that the largest he had ever heard of measured thirteen inches in length, and weighed half a pound.

THE UMBER, OR GRAYLING*.

The ancient writers strongly recommended these fish for the food of sick persons, as peculiarly wholesome, and

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* SYNONYMS. Salmo thymallus. *Linnæus*.—Le Corégone thymalle. *La Cepede*.—L'Ombre d'Auvergne. *Bloch*.

of easy digestion. They also attributed to oil made from its fat, the property of obliterating the marks of small-pox, freckles, and other spots on the skin. The season of the year during which these fish is considered in greatest perfection, is from September to January.

Grayling chiefly delight in rapid streams, where they afford great amusement to the angler. They are very voracious, and rise eagerly to the fly. They are bolder fish than the trout, and if missed even several times successively, will oftentimes still pursue. So rapid are their motions in the water, that their name of Umber has been from thence derived. Ausonius says of them,

"The Umbra swift, escapes the quickest eye."

They feed principally on worms, insects, and water-snails; and the shells of the latter are oftentimes found in great quantity in their stomachs. They spawn in the months of April and May. The largest fish of this species that I have heard of, was one caught in the Severn, which weighed five pounds.

The stomach of the Umber is so hard and thick, that it appears to the touch almost like cartilage. Linnæus asserts, that the inhabitants of Lapland employ the entrails of these fish in the place of rennet, in the making of cheese from the milk of the rein-deer.

OF THE PIKE TRIBE.*

It does not appear that more than three species of Pike were known to the ancients. The species at present

* In the whole of the Pike tribe the head is somewhat flat, and the upper jaw shorter than the other. The gill-membrane has from seven to twelve rays. The body is long, slender, compressed

known, are fifteen in number, of which four are natives of the British shores and rivers. They are all predatory fish, but few of them are so voracious as the Common Pike. They multiply fast, and increase quickly in size. Their velocity in the water is very great, and their general muscular powers are beyond those of most other fish.

THE COMMON PIKE †.

There is scarcely any fish of its size in the world, that in voracity can equal the Pike. One of them has been known to choak itself in attempting to swallow another of its own species, that proved too large a morsel: and it has been well authenticated, that in Lord Gower's canal at Trentham, a Pike seized the head of a swan as she was feeding under water, and gorged so much of it, as killed them both.

"I have been assured (says Walton) by my friend Mr. Seagrave, who keeps tame otters, that he has known a Pike, in extreme hunger, fight with one of his otters for a carp that the otter had caught, and was then bringing out of the water."

Boulker, in his Art of Angling, says, that his father caught a Pike, which he presented to Lord Cholmondeley, that was an ell long, and weighed thirty-five pounds. His lordship directed it to be put into a canal in his garden, which at that time contained a great quantity of fish. Twelve months afterwards the water was drawn off, and it was discovered that the Pike had devoured all the fish except a single large carp, that weighed between nine

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at the sides, and covered with hard scales. The dorsal fin is situated near the tail, and generally opposite to the anal fin.

† SYNONYMS. Esox lucius. *Linn.*—Pike, or Pickerell. *Will. Ich.*—*Penn. Brit. Zool. vol.* iii. *tab.* 63.—Le Brochet, in France.

and ten pounds; and even this had been bitten in several places. The Pike was again put in, and an entire fresh stock of fish for him to feed on: all these he devoured in less than a year. Several times he was observed by workmen who were standing near, to draw ducks and other water-fowl under water. Crows were shot and thrown in, which he took in the presence of the men. From this time the slaughtermen had orders to feed him with the garbage of the slaughter-house; but, being afterwards neglected, he died, as it is supposed, from want of food.

In December, 1765, a Pike was caught in the river Ouse, that weighed upwards of twenty-eight pounds, and was sold for a guinea. When it was opened, a watch with a black riband and two seals were found in its body. These, it was afterwards discovered, had belonged to a gentleman's servant, who had been drowned in the river about a month before.

Gesner relates, that a famished Pike, in the Rhone, seized on the lips of a mule, and was, in consequence, dragged out of the water; and that people, while washing their legs, had often been bitten by these voracious creatures.

The smaller fish exhibit the same fear of this tyrant, as some of the feathered tribe do of the rapacious birds, sometimes swimming round him, while lying dormant near the surface, in vast numbers, and with great anxiety.

If the accounts of different writers on the subject are to be credited, the longevity of the Pike is very remarkable. Gesner goes so far, as to mention a Pike, whose age was ascertained to be 267 years.

Pikes spawn in March or April. When they are in high season, their colours are very fine, being green, spotted with bright yellow, and having the gills of a most vivid red. When out of season, the green changes to gray, and the yellow spots become pale. Though some-

what bony fish, they are in general esteem as food; and on the Continent, where they are caught in great abundance, they are dried, and exported to other countries for sale.

They are often taken while lying asleep near the surface of the water, by means of a snare, at the end of a pole, gently passed over their head; which, by a sudden jerk, draws close, and brings them to land.

The Common Pike are found in considerable quantity in most of the lakes in Europe, Lapland, and the northern parts of Persia, where they sometimes measure upwards of eight feet in length.

OF THE MULLET TRIBE.

The lips of these fish are membranaceous, and the lower one is carinate inwards. They have no teeth in the jaws, but on the tongue and palate only. Above the angle of the mouth there is a hard callus. The gill-membrane has seven incurvated rays. The gill-covers are smoooth and rounded.

THE WHITE OR COMMON MULLET *.

There are few parts of the globe which border upon the sea, where the White Mullet are not found. It is one of those species of fish, which, at certain seasons of the year, pass from the sea into the rivers. These they usually enter in the months of May, June, and July. Fresh water is so little injurious to the Mullet, even for permanent residence, that it is said they may even be kept

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* SYNONYMS. Mugil cephalus. *Linnæus.*—La Muge céphale. *La Cepede.*—Le Mulet. *Bloch.*—*Penn. Brit. Zool. vol.* iii. *tab.* 66.

through the whole year, in lakes which have sandy bottoms.

They usually appear in immense shoals, and swim very near the surface of the water. When the fishermen observe an unusual rippling in the water, and also perceive the water at a distance to have a peculiarly blue appearance, they know that a shoal of Mullet is there. The general mode in which they are caught, is by seine nets. In some parts of the Continent, the fishermen endeavour, by making violent noises, to drive the fish into their nets; but these are so cunning, that, when surrounded with the net, the whole shoal will sometimes escape; for, if one of them springs over it, the rest, like sheep, are sure to follow their leader. This circumstance was noticed by Oppian:

> The Mullet, when encircling seines enclose,
> The fatal threads and treach'rous bosom knows:
> Instant he rallies all his vigorous powers,
> And faithful aid of every nerve implores;
> O'er battlements of cork up-darted flies,
> And finds from air th' escape that sea denies.

In order to obviate this inconvenience, the fishermen, in some parts of the Continent, use a kind of double net, so formed, that the second net shall catch those fish which overleap the first.

Mullet are in considerable esteem for the table; and are in best season about the month of August. They are usually eaten boiled; and, on the Continent, the most common sauce for them is oil and lemon-juice.

A kind of caviar is made from the roes of the White Mullet. This has the name of *botargue*, and is prepared as follows: When the fish are opened, the roes are taken out and salted. Four or five hours afterwards, they are pressed between two boards, in order to squeeze the water from them. They are then washed in weak brine, and

dried in the sun. As this operation takes place in the summer, the caviar becomes perfectly dry and fit for use in the course of ten or fifteen days.

OF THE FLYING-FISH IN GENERAL.*

These fish chiefly inhabit the seas of hot climates. They are occasionally found within the temperate regions; and an individual of the common species was, some years ago, caught on the Welch coast. There are only three known species.

THE COMMON FLYING-FISH†.

The wings, as they are usually denominated, with which these fish have the power of raising themselves into the air, are nothing more than large pectoral fins, composed of seven or eight ribs or rays, connected by a flexible, transparent, and glutinous membrane. They have their origin near the gills, and are capable of considerable motion backwards and forwards. These fins are used also to aid the progress of the fish in the water.

The Flying-fish has numerous enemies in its own ele-

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* The head is covered with scales, and the mouth is destitute of teeth. The belly is angular, and the pectoral fins are almost as long as the body.

† Description. This Flying-fish, if we except its head and flat back, has, in the form of its body, a great resemblance to the herring. The scales are large and silvery. The pectoral fins are very long; and the dorsal fin is small, and placed near the tail, which is forked.

Synonyms. Exocœtus volitans. *Linn.*—Hirundo, of the ancients. *Penn. Brit. Zool. vol.* iii. *tab.* 67.—Le Poisson volant, in France.

ment; the dorado, thunny, and many others, pursue and devour it. To aid its escape, it is furnished with these long pectoral fins, by which it is able to raise itself into the air, where it is often seized by the albatross or tropic birds. Its flight is short, seldom more than sixty or seventy yards at one stretch; but, by touching the surface at intervals to moisten its fins, it is able to double or treble this distance. The whole flight, however, is of so short a duration, that even in the hottest weather, its fins do not become dry. By touching the water it not only wets its fins, but seems to take fresh force and vigour, in another spring into an element, where it is not long able to support its weight by the clumsy motion of its fins. If the Flying-fishes were solitary animals, they would not be worth the pursuit of some of their larger enemies: they are very seldom seen to rise singly from the water, but generally appear in large shoals.

It has been inconsiderately remarked, that "all animated nature seems combined against this little fish, which possesses the double powers of swimming and flying, only in order to subject it to greater dangers. If it escape its enemies of the deep, it is only to be devoured by the sea-fowl, which are waiting its appearance in the air." Its destiny is, however, by no means peculiarly severe: we should consider that, as a fish, it often escapes the attack of birds; and, in its winged character, the individuals frequently throw themselves out of the power of fishes.

The eyes of these fish are so prominent, as to admit of their seeing danger from whatever quarter it may come; but, on emergency, they are able, in addition, to push them somewhat beyond the sockets, so as considerably to enlarge their sphere of vision.

They are frequently either unable to direct their flight out of a straight line, or else they become exhausted on a

sudden; for sometimes whole shoals of them fall on board the ships that navigate the seas of warm climates.

In the water, they have somewhat the manner of the swallow in the air, except that they always swim in straight lines; and the blackness of their backs, the whiteness of their bellies, and their forked and expanded tails, give them much the same appearance.

They were known to the ancients; for Pliny mentions them under the name of *Hirundo*, and relates their faculty of flying.—They are natives of the European, the American, and the Red Seas; but are chiefly found in those betwixt the tropics.

*OF THE HERRING TRIBE**.

These fish inhabit the depths of the ocean. They feed on molluscæ, and various kinds of small crustaceous animals. They also devour several kinds of shell-fish. Three of the species, the Common Herring, the Shad, and the Anchovy, were known to the ancients, and, as articles of food, were held by them in considerable esteem. It is not known that any of these fish are natives of fresh waters. Most of the species are migratory, and generally in immense shoals; and most, if not all of them, are excellent food.

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* The bodies of these fish are compressed, and covered with scales; and the belly is extremely sharp, sometimes forming a serrated ridge. In the gill-membrane there are eight rays. The jaws are unequal, and the upper one is furnished with serrated mystaces or connecting bones. The tail is forked

THE COMMON HERRING*.

Herrings are found in the greatest abundance in the highest northern latitudes. In those inaccessible seas that are covered with ice for a great part of the year, they find a quiet and sure retreat from all their numerous enemies. The quantity of food which those seas supply is immensely great.

Thus remotely situated, and defended by the icy rigour of the climate, they live at ease, and multiply beyond expression, coming out from thence in such shoals, that, were all the men in the world to be loaded with herrings, they could not carry off the thousandth part of them. Their enemies are, however, extremely numerous: all the monsters of the deep find them an easy prey; and, in addition to these, the immense flocks of sea-fowl that inhabit the polar regions, watch their outset, and spread devastation on all sides.

In their outset, this immense swarm of living creatures is divided into distinct columns, of five or six miles in length, and three or four in breadth, and in their progress they even make the water ripple before them.

They are found about the Shetland islands in June, from whence they proceed down to the Orkneys, and, then dividing, surround the islands of Great Britain and Ireland, and unite again, off the Land's End, in the British Channel, in September; from whence the great united body steers south-west, and is not found any more on that side, or in the Atlantic, until the same time in the ensuing year, but next appear on the American coasts. They

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* SYNONYMS. Clupea harengus. *Linn.*—Le Hareng, in France. —*Penn. Brit. Zool. tab.* 68.

arrive in Georgia and Carolina about the latter end of January, and in Virginia in February. From hence they coast eastward to New England. They then divide, and go into all the bays, rivers, creeks, and even small streams of water, in amazing quantities, and continue spawning in the fresh water until the latter end of April, when the old fish return into the sea, where they change their latitudes by a northward direction, and arrive at Newfoundland in May. After this they are no more seen in America till the following spring. Their passing sooner or later up the American rivers, depends on the warmth of the season; and even if a few warm days invite them up, and cool weather succeeds, their passage is immediately checked till the heat becomes more powerful. Thus they are found in the British Channel in September, but leave it when the sun is at too great a distance from them, and push forwards towards a more agreeable climate. And when the weather in America becomes too warm in May, (after having deposited their eggs,) they steer the course which leads to the cooler northern seas, and, by this careful change of place, perpetually enjoy the temperature of the climate best suited to their nature.

The young do not follow the old ones in their first migrations; for they are to be seen in great shoals in all the American bays till the autumn, when they disappear. Since it seems that the Herrings have a natural propensity to keep at a certain distance from the sun, we may conclude that, at this season of the year, the young are led in a direction contrary to that of the old ones, which they meet about latitude 23° north, and 70° west longitude. Here they are supposed to tack about, and follow the others. These, being larger and stronger, come first into the American harbours: their numbers, however, are then considerably diminished by the devastations committed among them during their absence.

The fecundity of the Herring is astonishing. It has been calculated, that if the offspring of a single Herring could be suffered to multiply unmolested and undiminished for twenty years, they would exhibit a bulk of ten times the size of the earth. But, happily, Providence has so exactly contrived the balance of nature, by giving them innumerable enemies, as always to keep them within proper bounds.

In the year 1773, the Herrings were in such immense shoals on the Scotch coasts for two months, that it appears, from tolerably accurate computations, no less than 1650 boat-loads were taken in Loch Terridon every night. These would amount to nearly 20,000 barrels.

They once swarmed so greatly on the west side of the isle of Skye, that the numbers caught were more than could possibly be carried away. After the boats were all loaded, and the country round was served, the neighbouring farmers made them up into composts, and manured their ground with them in the ensuing season. This shoal continued to frequent the coast for many years, but not always in numbers equal to these.

Somewhat more than thirty years ago, the Herrings came into Loch Urn in such amazing quantities, that from the narrows to the very head, about two miles, it was quite full. So many of them were pushed on shore, that the beach, for four miles round the head, was covered with them, from six to eighteen inches deep; and the ground under water, as far as could be seen when the tide was out, was equally so. Indeed, so thick and so forcible was the shoal, as to carry before it every other kind of fish; even ground-fish, skate, flounder, &c. were driven on the shore with the first of the Herrings, and perished there.

The principal of the British Herring fisheries, are off the Scotch and Norfolk coasts; and, in our seas, the fish-

ing is always carried on by nets stretched in the water, one side of which is kept from sinking, by means of buoys fixed to them at proper distances; and as the weight of the net makes the side sink, to which no buoys are fixed, it is suffered to hang in a perpendicular position, like a screen; and the fish, when they endeavour to pass through it, are entangled in its meshes, from which they cannot disengage themselves. There they remain till the net is hauled in, and they are taken out.

The nets are seldom stretched for the purpose of catching Herrings, but during the night, for in the dark they are to be taken in much the greatest abundance. When the night is dark, and the surface of the water is considerably ruffled by the wind, the fishermen always assure themselves of the greatest success. Nets stretched in the day-time, are supposed to frighten the fish away.

In order to strengthen the nets, and render the threads more compact, they are all tanned. For this purpose, a quantity of oak-bark is boiled: the liquor is then strained off, and further boiled, till it has attained such a consistence, that when a little is dropped on the thumb-nail, it will become thick as it cools. The nets are then put into a large vessel, and this liquor is poured, while hot, upon them. They are suffered to lie four-and-twenty hours, when they are taken out and dried. The same process is repeated three times. Nets that have undergone this operation, are supposed to last thrice as long as they would do without it.

Herrings die almost the moment after they are taken out of the water; whence originated the adage, in common use, *as dead as a Herring*. They also become very soon tainted after they are killed. In summer, they are sensibly worse for being out of the water only a few hours; and, if exposed but a few minutes to the rays of

the sun, they are perfectly useless, and will not take the salt.

When the fishermen on the Scotch coast have plenty of salt, Herrings sell for about six shillings a barrel. As their salt is expended, the price falls to five, four, three, two, and one shilling per barrel; sometimes even to sixpence or eight-pence; below which prices the men will seldom shoot their nets, as a less price is not sufficient to indemnify them for the trouble of catching them. But it sometimes happens that a barrel of fine fresh Herrings may be purchased for a single chew of tobacco. A barrel contains from six hundred to sixteen hundred fish, according to their size.

After the nets are hauled, the fish are thrown upon the deck of the vessel, and each of the crew has a certain task assigned to him. One part is employed in opening and gutting them; another in salting, and a third in packing them in the barrels in layers of salt. The red Herrings lie twenty-four hours in the brine; they are then taken out, strung by the head on little wooden spits, and hung in a chimney formed to receive them; after which a fire of brush-wood, which yields much smoke, but no flame, is kindled under them, and they remain there till sufficiently smoked and dried; when they are put into barrels for carriage.

THE PILCHARD *.

About the middle of July, the Pilchards, which are a smaller species of herring, appear in vast shoals off the

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* Description. The chief difference between the Pilchard and the Herring is, that the body of the former is more round and thick; the nose shorter in proportion, turning up; and the under jaw shorter. The back is more elevated, and the belly not so sharp.

coasts of Cornwall. These shoals remain till the latter end of October, when it is probable they retire to some undisturbed deep, at a little distance, for the winter. It has been supposed, but improperly, that, like the herring, they migrated into the Arctic regions. If Pilchards performed any migration northward, we should certainly have heard of their being occasionally seen and caught on their passage; but of this we have no one authenticated instance. The utmost range of the Pilchards seems to be the Isle of Wight in the British, and Ilfracomb in the Bristol Channel. Forty years back, Christmas was the time of their departure; this alteration in time is a very singular fact.

We have the following account of the fishery from Dr. Borlase:—"It employs (he says) a great number of men on the sea, training them thereby to naval affairs; employs men, women, and children, at land, in salting, pressing, washing, and cleaning; in making boats, nets, ropes, casks; and in all the trades depending on their construction and sale. The poor are fed with the offals of the captures, the land with the refuse of the fish and salt, the merchant finds the gains of commission and honest commerce, the fisherman the gains of the fish. Ships are often freighted hither with salt, and into foreign countries with the fish, carrying off, at the same time, part of our tin. From a statement of the number of hogsheads exported each year, for ten years, from 1747 to 1756 inclusive, from the four

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The scales adhere very closely, whilst those of the herring easily drop off. It is also in general of considerably smaller size. But perhaps the situation of the dorsal fin is as good a criterion as any. This in the Pilchard is so backward, that the fish, when held up by it, dips from a horizontal line forward: when the herring is held by its dorsal fin, it remains in equilibrio.

SYNONYMS. Clupea pilcardus. *Turton's Linn.*—Le Pilchard, by the French.—*Penn. Brit. Zool. tab.* 68.

ports of Tawy, Falmouth, Penzance, and St. Ives, it appears that Tawy has exported *yearly* 1732 hogsheads; Falmouth, 14,631 hogsheads and two thirds; Penzance and Mounts-bay, 12,149 hogsheads and one-third; St. Ives, 1282 hogsheads: in all amounting to 29,795 hogsheads. Every hogshead, for ten years last past, together with the bounty allowed for exportation, and the oil made out of it, has amounted, one year with another, at an average, to the price of one pound thirteen shillings and three-pence; so that the cash paid for Pilchards exported has, at a medium, annually amounted to the sum of 49,532*l*. 10*s*.

When Dr. Maton made his tour of the western counties, he and a friend hired a boat to go out and see the Pilchard-fishing at Fowy, near Looe, in Cornwall. He says, that the fishing-boats, which are numerous, are usually stationed in ten fathoms water, and clear of all breakers. Light sail-boats keep out at a little distance before them, to give notice to the fishermen of the approach of a shoal. Persons are also frequently stationed on the neighbouring rocks, to watch the course of the fish: these are called *huers*, from the circumstance of their setting up a *hue* to the fishermen.

The nets, which are seines, are sometimes two hundred fathoms or more in circumference, and about eighteen deep. Some of them are said to be capable of holding upwards of two hundred hogsheads of fish, each containing about three thousand. About thirty thousand hogsheads are here looked upon as a tolerably good produce for one season. But it happens now and then that the fishery almost entirely fails. About ten years before Dr. Maton was at this place, the fishermen and their families had been compelled to live for some time solely on limpets and other shell-fish, which they cannot, in any other circumstance, be prevailed with to eat.

The Dog-fish * are great enemies to the Pilchards, often devouring them in amazing numbers.

THE SPRAT† AND SHAD‡.

Sprats are caught on the coasts of the Mediterranean, in such immense shoals, that at a single haul of a large net, as many have sometimes been landed as would have filled betwixt forty and fifty barrels. From the circumstance of these fish being caught near the island of Sardinia in great abundance, and being exported from thence, in barrels, to various parts of the world, they have obtained, in several countries, the name of *Sardine.* Sprats are likewise found in the North Sea and the Baltic.

They usually frequent the deep parts of the sea; but in the autumn they approach the smooth and sandy shores, for the purpose of depositing there their spawn. They come into the Thames about the beginning of November, and leave it in March; and, during that season, as Mr. Pennant remarks, they afford a great relief to the poor people of the capital. At Gravesend and at Yarmouth, they are cured like red herrings. They are also sometimes pickled, and, in this state, are little inferior in flavour to anchovy; but the bones will not dissolve like those of that fish.

Shads appear in the river Rhine in the month of March; in the Severn and Thames, in April, May, and June; and in the Nile, in December and January. As soon as they arrive, they deposit their spawn in places where the current

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* *Squalus catulus,* and *Squalus canicula,* of Linnæus.

† Synonyms. Clupea sprattus. *Linn.*—La Sardine. *Bloch.*

‡ Synonyms. Clupea alosa. *Linn.*—L'Alose, in some parts of France.

is most rapid; and, some months afterwards, return to the sea.

They ascend the Rhine as far as Basil, where they are caught, in great quantity, in nets, and osier baskets or traps. In order to attract them into the latter, the fishermen use a bait of peas, prepared in a certain way with myrrh, which is put into a small bag, and suspended in the inside. When caught by means of lines, an earthworm is used for a bait.

It has been asserted that Shads delight in music, and are afraid of storms. They are so little tenacious of life, that, like the herring, they always die as soon as they are taken out of the water.

When these fish are taken out of the sea, they are thin and ill flavoured; but the longer they continue in the rivers, the fatter and more eatable they become. In the Severn they are considered very delicate fish, especially in that part of the river which flows by Gloucester, where they are usually sold at a price higher than that of salmon. The Thames Shad is esteemed a very coarse and insipid fish. In most countries the males are considered less delicate food than the females.

THE ANCHOVY*.

Like the herrings and the sprats, these fish leave the deeps of the open sea in order to frequent the smooth and shallow places of the coasts, for the purpose of spawning. Betwixt the months of December and March, immense numbers are caught on the shores of Provence, Brabant, and Catalonia; in June and July, in the English Channel, and in the environs of Venice, Genoa, Rome, and Bayonne.

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* SYNONYMS. Clupea encrasicolus. *Linn.*—L'Anchois. *Bloch.*

The fishermen generally light a fire on the shore, for the purpose of attracting the Anchovies, when they fish for them in the night. After they are cleansed and their heads are cut off, they are cured in a certain way, and packed in small barrels for sale and exportation. The ancient Greeks and Romans prepared from the Anchovy a liquid, which they denominated *garum*, and which was highly esteemed by most of the epicures of that day.

Anchovies are occasionally found both in the North Sea and in the Baltic; but it is supposed that they are in much greater quantity in the Mediterranean, than in any other part of the world. They have sometimes, though very rarely, been caught in the river Dee, on the coasts of Flintshire and Cheshire.

OF THE CARP TRIBE.*

Most of the Carp tribe inhabit the fresh waters, where they feed on worms, insects, aquatic plants, fish, and clay or mould. Some of them are migratory. The greater part of the species, which are very numerous, are found only in the northern countries of Europe; and, consequently, were unknown to the ancient naturalists of Greece and Rome.

THE COMMON CARP †.

In their general habits, these fish exhibit so great a degree of cunning, as to be sometimes called by the country

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* The Carp have small mouths, and no teeth; and the gill-membrane has three rays. The body is smooth, and generally whitish. On the back there is only one fin.

† Description. The form of the Carp is somewhat thick, and its colour blue-green above, greenish yellow mixed with black on

people *River Fox*. When attempted to be taken by a net, they will often leap over it; or immerse themselves so deep in the mud, as to suffer the net to pass over without touching them. They are also very shy of taking a bait; but, during spawning-time, so intent are they on the business of depositing their ova, that they will suffer themselves to be handled by any one who attempts it. They breed three or four times in the year, but their first spawning is in the beginning of May.

Carp are found in the slow rivers and stagnant waters of Europe and Persia; and here principally in deep holes, under the roots of trees, hollow banks, or great beds of flags, &c. They do not often exceed four feet in length, and twenty pounds in weight; but Jovius mentions some, caught in the Lago di Como, in Italy, that weighed two hundred pounds each; and others have been taken in the Dneister five feet in length.

From their quick growth and vast increase, these are considered as the most valuable of all fish for the stocking of ponds *; and if the breeding and feeding of them were better understood, and more practised, than they are, the advantages resulting from them would be very great. A pond stocked with these fish would become as valuable to its owner as a garden. In many parts of Prussia, Carp are bred in great quantities, and are thus made to form a considerable part of the revenue of the principal personages of

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the upper part of the sides, whitish beneath, and the tail yellow or violet. The scales are large. On each side of the mouth there is a single beard, and above this another shorter. The dorsal fin is long, extending far towards the tail, which is forked.

SYNONYMS. Cyprinus carpio. *Linn.*—La Carpe. *Bloch.*—*Penn. Brit. Zool. tab.* 70.

* The roe, when taken out, has frequently been found greater in weight than the whole remainder of the fish.

the country, being sent from thence, in well-boats, into Sweden and Russia, where they are very scarce.

By being constantly fed, they may be rendered so familiar as always to come to the side of the pond where they are kept, for food. Dr. Smith, speaking of the Prince of Condé's seat at Chantilly, says, "The most pleasing things about it were the immense shoals of very large Carp, silvered over with age, like silver fish, and perfectly tame; so that, when any passengers approached their watery habitation, they used to come to the shore in such numbers as to heave each other out of the water, begging for bread, of which a quantity was always kept at hand on purpose to feed them. They would even allow themseves to be handled."—Sir John Hawkins was assured by a clergyman, a friend of his, that at the abbey of St. Bernard, near Antwerp, he saw a Carp come to the edge of its pond, at the whistling of the person who fed it.

Carp are very long-lived: the pond in the garden of Emanuel College, Cambridge, contained a Carp that had been an inhabitant more than seventy years; and Gesner has mentioned an instance of one that was an hundred years old. They are also extremely tenacious of life, and will live for a great length of time out of water. An experiment has been made by placing a Carp in a net, well wrapped up in wet moss, (the mouth only remaining out,) and then hanging it up in a cellar or some cool place.—The fish in this situation is to be frequently fed with white bread and milk, and is besides to be often plunged in water. Carp thus managed have been known, not only to live above a fortnight, but to have grown exceedingly fat, and become far superior in taste to those immediately taken from the pond.

These fish were first introduced into this country about three hundred years ago. Of their sound or air-bladder a kind of fish-glue is made; and a green paint of their gall.

THE TENCH *.

Tench are partial to foul and weedy waters; and their haunts in rivers are chiefly among weeds, and in places well shaded with rushes. These fish thrive best in standing waters, where they lie under weeds, near sluices and pond heads. They are much more numerous in pools and pits than in rivers; but those taken in the latter, are far preferable for the table.—They begin to spawn in June, and may be found spawning in some waters till September. The best season for them is from that time until the end of May.

They do not often exceed four or five pounds in weight. Mr. Pennant, however, mentions one that weighed ten pounds.—The Tench is in great repute with us, as a delicious and wholesome food; but in Germany it is considered a bad fish, and in contempt is called *Schoemaker*.

It is singular enough, that the slime of the Tench is supposed to possess such healing properties among the fish, that, it is said, the pike, on this account, never attempts to devour it, though he seizes, without exception, on all the other species that he is able to overcome.

> The Pike, fell tyrant of the liquid plain,
> With ravenous waste devours his fellow train:
> Yet, howsoe'er with raging famine pin'd,
> The Tench he spares, a medicinal kind;
> For when by wounds distrest, or sore disease,
> He courts the salutary fish for ease,
> Close to his scales the kind physician glides,
> And sweats a healing balsam from his sides.

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* SYNONYMS. Cyprinus tinca. *Linn.*—Tinca. *Ausonius.*—La Tanche. *Bloch.*

This self-denial of the Pike may, however, be attributed to a more natural cause: The Tench are so fond of mud as to be constantly at the bottom of the water, where, probably, they are secure from the voracious attacks of their neighbour.

Tench are sometimes found in waters where the mud is excessively fetid, and the weeds are so thick that a hand-net can scarcely be thrust down. In these situations they grow to a large size, and their exterior becomes completely tinged by the mud. Their flavour from this, if cooked immediately on being taken out, is often very unpleasant; but, if they are transferred into clear water, they soon recover from the obnoxious taint.

In November, 1801, a Tench was taken at Thornville Royal, in Yorkshire, of such enormous size, and so singular in its shape, as to be accounted rather a *lusus naturæ*, than a regular production. A piece of water which had been ordered to be filled up, and into which wood and rubbish had been thrown for some years, was directed to be cleared out. So little water remained, and in such quantity were the weeds and mud, that it was expected no fish would be found, except perhaps a few eels; but greatly to the surprise of the persons employed, nearly two hundred brace of Tench, and as many of Perch, were discovered. After the pond was supposed to be quite cleared, an animal was observed to lie under some roots, which was conjectured to be an otter. The place was surrounded, and, on making an opening, a Tench of most singular form was found, having literally taken the shape of the hole in which he had of course been for many years confined. His length was *two feet nine inches*, his circumference two feet three inches, and his weight nearly twelve pounds. The colour was also singular, his belly being tinged with vermilion. This extraordinary fish, after having been ex-

amined by many gentlemen, was carefully put into a pond. At first it merely floated, but after a while it swam gently, though with difficulty, away. It is probably yet alive.

Tench are foolish fish, and are usually caught with a line, without difficulty. The baits generally adopted are the small red worms taken out of rotten tan, wasp maggots, or marsh worms. The season for angling for them is from September to June. They will bite during the greater part of the day, but the expert angler generally attends as early and late as possible.

THE GUDGEON *.

The food of the Gudgeon consists of aquatic plants, worms, the larvæ of water insects, and the spawn of fish. They usually swim in small shoals, and are found in gentle streams, where the bed is of sand or gravel. If the bed of the stream be raked or stirred up, they eagerly collect round the spot, and are easily caught with lines baited with small earth-worms. In a village about five or six miles from Norwich, the poor people fish for Gudgeons in an adjacent stream. The mode in which this is done is as follows: They cut two spines of the white thorn, and fixing them at right angles, attach them to a piece of packthread, (having previously put on them a worm,) and fasten the other end to a stick, which they hang over the stream. They sometimes make as many as a hundred of these; and never fail to catch, by means of them, a great number of fish.

The flesh of the Gudgeon is white, of excellent flavour, and easy of digestion. In the months of September and

* SYNONYMS. Cyprinus gobio. *Linn.*—Le Goujon. *Bloch.*—Goujon de Rivière, in some parts of France.

October, these fish are taken in the rivers of some parts of the Continent, in great abundance; and the markets are well supplied with them. They are caught both in nets and with lines.

THE CHUB *.

The Chub is altogether a handsome fish; but not in esteem for the table, being very coarse, and, when out of season, full of small, hairy bones.—Its name is derived from the shape of its head; and the French and Italians know it by a name synonymous with ours.

Its haunts are rivers, whose bottoms are of sand or clay, or which are bounded by clayey banks; in deep holes, under hollow banks, shaded by trees or weeds. These fish often float on the surface, and are sometimes found in deep waters, where the currents are strong. In ponds fed by a rivulet they grow to a great size. They seldom, however, exceed the weight of four or five pounds.

They deposit their spawn in April; and are in greatest perfection during the months of December and January.

When the Chub seizes a bait, he bites so eagerly that his jaws are often heard to chop like those of a dog. He, however, seldom breaks his hold, and, when once he is struck, is soon tired.—The time of angling is from August to March, but best in the winter months. In mild, cloudy weather, the Chub will bite all day: in hot weather, from sunrise till nine o'clock; and from three in the afternoon till sunset. In cold weather the best time is the middle of the day. The baits are various kinds of worms and flies.

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* SYNONYMS. Cyprinus cephalus. *Linn.*—Chubb or Chevin. *Will.*—Nob or Botling. *Daniel.*—*Penn. Brit. Zool. vol.* iii. *tab.* 73.

THE DACE *.

The Dace is a gregarious and lively fish; and during summer is fond of playing near the surface of the water. It is generally found where the water is deep, and the stream gentle, near the piles of bridges. It also frequents deep holes that are shaded by the leaves of the water-lily; and under the foam on the shallows of streams.

These fish seldom weigh more than a pound and a half; but they are exceedingly prolific. They spawn in March; and are in season about three weeks afterwards. They improve, and are good about Michaelmas, but are best in February. In this month, if, when just taken out of the water, they are scotched and broiled, they are said to be even more palatable than a herring. Their flesh, however, is generally insipid and full of bones.

Dace afford great amusement to the angler. The baits are various kinds of worms, and the common *flesh-flies.* The season of angling is from April to February, but best in the winter. In hot weather, the time is early and late in the day: in cold weather, during the middle; and in mild, cloudy weather, the whole of the day.

THE ROACH †.

This fish is found chiefly in deep, still rivers, where it is often seen in large shoals. In summer, it frequents shallows near the tails of fords; or lies under banks among

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* SYNONYMS. Cyprinus leuciscus. *Linn.*—Dace or Dare. *Will.*—La Vandoise, in France.

† SYNONYMS. Cyprinus rutilus. *Linn.*—Roche. *Will.*—*Penn. Brit. Zool. Frontis. vol.* iii.—La Rosse, in France.

weeds, and shaded by trees or herbage, especially where the water is thick. As the winter approaches, these haunts are changed for deep and still waters.

The Roach is so silly a fish, that it has acquired the name of the *Water-sheep*, in contradistinction to Carp, which from its subtlety is termed the River-fox.—*Sound as a Roach*, is a proverb that appears but indifferently founded. It is, however, used by the French as well as by us.

This is a handsome fish, either in the water, or when immediately taken out of it. The flesh, although reckoned wholesome, is in little esteem, on account of the great quantity of bones. When Roach are in season, which is from Michaelmas to March, their scales are very smooth; but when they are out of season, these feel like the rough side of an oyster-shell. Their fins also are generally red when the animals are in perfection. They spawn towards the latter end of May, and for three weeks after are unwholesome. They begin to recover in July, but it is Michaelmas before they are eatable. They are said to be best in February or March. The roe is green, but boils red, and is peculiarly good. These fish differ greatly in goodness, according to the rivers in which they are caught. None are good that are kept in ponds.

Roach feed on aquatic plants and vermes. Their usual weight is from half a pound to two pounds. Some, however, have been known to weigh as much as five pounds.

The baits used in catching Roach are various kinds of worms, flies, and pastes. The time for angling is, in mild cloudy weather, all the day; in hot weather only in the mornings and evenings; and in cold weather, during the middle of the day

THE GOLD FISH *.

Gold Fish are natives of China; and the most beautiful kinds are caught in a small lake in the province of Che-kyang, at the foot of a mountain called Tsyen-king. They were first introduced into England about the year 1691, but were not generally known till thirty years afterwards.

In China they are kept in ponds, or large porcelain vessels, by almost every person of distinction. In these they are very lively and active, sporting about the surface of the water with great vivacity; but they are so very delicate, that, if great guns are fired, or any substances giving out a powerful smell, as pitch or tar, are burned near them, numbers of them will be killed.—In each of the ponds or basins where they are kept, there is an earthen pan, with holes in it, turned upside down. Under this they retire when, at any time, they find the rays of the sun too powerful. The water is changed three or four times a week. Whilst this is done, it is necessary to remove the fish into another vessel; but they are always taken out by means of a net, for the least handling would destroy them.

When Gold-fish are kept in ponds, they are often taught to rise to the surface of the water at the sound of a bell, to be fed. At Pekin, for three or four months of the winter, or whilst the cold weather lasts, the fish in the ponds are not fed at all. They are able, during that time, to get the small quantity of food they require in the water. In order to prevent their being frozen, they are often taken into the houses, and kept in china vessels, till the warm weather of spring allows their being returned to their ponds with safety.

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* SYNONYMS. Cyprinus auratus. *Linn*.—Kin-yu, in China.—Gold Fish. *Penn*.—La Dorade Chinoise, in France.

In hot countries, Gold-fish multiply very fast, if care be taken to remove the spawn, which swims on the surface of the water, into other ponds; for otherwise, the animals would devour the greater part of it. The young fry, when first produced, are perfectly black; but they afterwards change to white, and then to gold colour. The latter colours appear first about the tail, and extend upwards.

The smallest fish are preferred, not only from their being more beautiful than the larger ones, but because a greater number of them can be kept. These are of a fine orange red, appearing as if sprinkled over with gold dust. Some, however, are white, like silver, and others white spotted with red. When dead they lose all their lustre. The females are known from the males by several white spots which they have near the gills, and the pectoral fins: the males have these parts very bright and shining.

In China the Gold-fish are fed with balls of paste, and the yolks of eggs boiled very hard. In England, many persons are of opinion that they need no aliment. It is true that they will subsist for a long while without any other food than what they can collect from water frequently changed; yet they must draw some support from animalcules and other nourishment supplied by the water. That they are best pleased by such slender diet may easily be confuted, since they will readily, if not greedily, seize crumbs that are thrown to them. Bread ought, however, to be given sparingly, lest, turning sour, it corrupt the water. They will also feed on the water-plant called duck's-meat, and on small fry.

Gold-fish do not often multiply in very close confinement. If it is desired to have them bred, they must be put into a tolerably large reservoir, through which a stream of water runs, and in which there are some deep places.

Chondropterygious Fish*.

OF THE STURGEONS IN GENERAL†.

All the species of Sturgeons are inhabitants of the sea, though some of them occasionally go up the wider rivers. All the species are large, seldom measuring, when full-grown, less than three or four feet in length. The flesh of the whole is reckoned extremely delicious; and to the inhabitants on the banks of the Caspian Sea, and indeed of many other parts both of Europe and America, these fish are very useful as an article of commerce. Their usual food is worms and other fish.

THE COMMON STURGEON‡.

The tendrils on the snout of the Sturgeon are some inches in length, and have so great a resemblance in form

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* The fishes of the order *Chondropterygii*, have cartilaginous gills.

† The head is obtuse; and the mouth, which is placed quite under the head, is tubular, and without teeth. Between the end of the snout and the mouth there are four cirri, or tendrils; and on each side there is a narrow aperture of the gills. The body is long in proportion to its thickness, and usually angular, from several rows of large bony plates.

‡ Description. The body of this fish, which is often found from six to sixteen feet in length, is pentagonal, being armed from head to tail with five rows of large bony tubercles, each of which ends in a strong recurved tip: one of these is on the back, one on

to earth-worms, that, at first sight, they might be mistaken for them. This clumsy, toothless fish, is supposed, by this contrivance, to keep himself in good condition, the solidity of his flesh evidently showing him to be a fish of prey. He is said to hide his large body among the weeds near the sea-coast, or at the mouths of large rivers, only exposing his tendrils: these, small fish or sea-insects, mistaking for real worms, approach for plunder, and are sucked into the jaws of their enemy. He has been supposed by some, to root into the mud at the bottom of the sea or rivers; but the tendrils above mentioned, which hang from his snout over his mouth, must themselves be very inconvenient for this purpose; and, as he has no jaws, he evidently lives by suction, and, during his residence in the sea, marine insects are generally found in his stomach.

At the approach of spring, Sturgeons leave the deep recesses of the sea, and enter the rivers to spawn; and from May to July the American rivers abound with them. Here they are often observed to leap to the height of several yards out of the water, which they do in an erect position, falling back again on their sides with such noise, as to be heard in the still evenings to a great distance. They have often been known, at these times, to fall into the small boats or canoes of the Indians, and sink them. On this account, it is often dangerous to pass the places

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each side, and two on the margin of the belly. The snout is long, and obtuse at the end, and has the tendrils near the tip. The mouth, which is beneath the head, is somewhat like the opening of a purse, and is so formed, as to be pushed suddenly out, or retracted. The upper part of the body is of a dirty olive colour; the lower part silvery; and the tubercles are white in the middle.

Sturgeons are found both in the European and American seas.

Synonyms. Acipenser sturio. *Linn.*—L'Esturgeon, in France. —*Penn. Brit. Zool. vol.* iii. *tab.* 19.

that are much frequented by them: many instances have occurred of people losing their lives by this means. Some of the Indians take advantage of this propensity to leaping, to catch them, by stationing themselves in tolerably large boats, in the places where they are seen, and receiving them as they fall.

In some rivers of Virginia, Sturgeons are found in such numbers, that six hundred have been taken in two days, with no more trouble than putting down a pole, with a hook at the end, to the bottom, and drawing it up again, on feeling it rub against a fish. They are, however, chiefly killed in the night with harpoons, attracted by the light of torches made of the wood of the black pine. On the shores are frequently seen the bodies of Sturgeons that have been wounded with the spears, and have afterwards died.

The Indians often fish for them in the lakes in the daytime. For this purpose there are usually two men to a canoe, one at the stern to work it forward, and the other at the head, with a pointed spear about fourteen feet long, tied to a long cord that is fastened to one of the cross timbers of the canoe. The moment a Sturgeon is seen within reach, the man at the head darts his spear into the tenderest part of the body that he can reach; and, if it penetrate, the fish swims off with astonishing velocity, dragging the canoe along the water after it. If, however, the blow has been pretty well aimed, the fish does not go more than two or three hundred yards before he dies; when the men draw up the line and take him. Sometimes, when Sturgeons are seen to lie at the bottom of the still water near the cataracts, they are struck with a spear without a rope, their place being marked, on their rising, by the appearance of the shaft above the water.

The Sturgeon annually ascends our rivers, in the summer, particularly those of the Eden and Esk, but in no great numbers. It is so spiritless a fish, that when caught

as it sometimes is, in the salmon nets, it scarcely makes any resistance, but is drawn out of the water apparently lifeless. One of the largest ever caught in our rivers, was taken in the Esk, about twenty-six years ago; it weighed four hundred and sixty pounds.

The flesh of the Sturgeon is well known to be extremely delicious; and it was so much valued in the time of the Emperor Severus, that it was brought to table by servants with coronets on their heads, and preceded by music. This might give rise to its being, in our country, presented by the Lord Mayor to the King. At present, the Sturgeons are caught in the Danube, the Volga, the Don, and other large rivers, for various purposes. The skin makes a good covering for carriages; *caviar* is prepared from the spawn; and the flesh is pickled or salted, and sent all over Europe.

To make the *caviar*, the spawn is freed from the little fibres by which it is connected, washed in white wine or vinegar, and afterwards spread out to dry. It is then put into a vessel and salted, (crushing it down with the hands,) and afterwards enclosed in a canvass bag to drain off the moisture. It is, last of all, put into a tub, with a hole in the bottom, that any remaining moisture may run off, pressed down, and closed for use.

It has been said, that *isinglass* is made of the skin of the Sturgeon: but this is a mistake; for the Sturgeon is altogether of so cartilaginous a nature, that no part of it will produce isinglass, except the inner coat of the air-bladder. The isinglass most common in our shops, is made from a species of dolphin, called the beluga*.

The bones are reported to be so hard, as to serve the American Indians for rasps and nutmeg-graters.

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* *Delphinus leucas* of Linnæus.

The fecundity of these fish is exceedingly great. Catesby says, that the females frequently contain a bushel of spawn each; and Leeuwenhoek found in the roe of one of them, no fewer than 150,000,000,000 eggs.

*OF THE SHARK TRIBE**.

The animals that compose this rapacious tribe, are entirely marine, and more frequent in the hot than the temperate climates. They are in general solitary, and often wander to vast distances, devouring almost every thing that comes in their way, that they are able to swallow. Some of them will follow vessels several hundred leagues, for the carcasses and filth that are thrown overboard. The size to which they grow is enormous, as they often weigh from one to four thousand pounds each. Some few species are gregarious, and live on the molluscæ and other marine worms. They are all viviparous; their young, when first protruded, being enclosed (alive) in a square, pellucid, horny case, terminated at the four corners by very long, slender filaments, which are generally found twisted round corallines, sea-weed, and other fixed substances.

Their flesh is altogether so tough, coarse, and of such a disagreeable smell, that even the young are scarcely eatable. Their bodies emit a phosphoric light in the dark.

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* The body is compressed, long in proportion to the thickness, and tapers towards the tail. The head is obtuse, and on the side of the neck there are from four to seven breathing apertures. The mouth, which is situated in the under part of the head, is armed with several rows of serrated, sharp-pointed teeth of different forms, some of which are fixed, and others moveable. The skin is covered with very slender prickles; and the upper part of the tail is generally longer than the lower.

The skin is rough, and is in general use for polishing ivory, wood, and other substances; thongs and carriage traces are also occasionally made of it. The liver is generally found to yield a considerable quantity of oil. There are upwards of thirty species, of which eleven are found in the British seas.

THE WHITE SHARK*.

This dreadful species of Shark has six rows of teeth, hard, sharply-pointed, and of a wedge-like figure. These he has the power of erecting and depressing at pleasure. When the animal is at rest, they are quite flat in his mouth; but, when prey is to be seized, they are instantly erected by a set of muscles that join them to the jaw. Thus, with open jaws, goggling eyes, and large and bristly fins, agitated like the mane of a lion, his whole aspect is an emphatical picture of the fiercest, deepest, and most savage malignity.

It is a fortunate circumstance, for those who would avoid its attacks, that its mouth is so situated, under the head, that it has to throw itself on one side in order to seize its prey; for its velocity in the water is so great, that nothing of which it was once in pursuit, would otherwise be able to escape its voracity.

These creatures are the dread of sailors in all the hot climates, where they constantly attend the ships, in expectation of what may drop overboard; and if, in this case, any of the men have that misfortune, they must inevitably perish.

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* Synonyms. Squalus carcharias. *Linn.*—La Lamie. *Bloch.*—Le Squale requin. *La Cepede.*—Le Requin, in France.

Increasing still the terrors of the storms,
His jaws horrific arm'd with threefold fate,
Here dwells the direful Shark. Lured by the scent
Of streaming crowds, of rank disease, and death,
Behold! he rushing cuts the briny flood,
Swift as the gale can bear the ship along;
And, from the partners of that cruel trade
Which spoils unhappy Guinea of her sons,
Demands his share of prey, demands themselves.
The stormy fates descend, one death involves
Tyrants and slaves; when straight, their mangled limbs
Crashing at once, he dyes the purple seas
With gore, and riots in the vengeful meal.

The master of a Guinea ship informed Mr. Pennant, that a rage for suicide prevailed among his slaves, from an opinion entertained by the unfortunate wretches, that, after death, they should be restored to their families, friends, and country. To convince them that their bodies could never be re-animated, he ordered the corpse of one that was just dead, to be tied by the heels to a rope, and lowered into the sea. It was drawn up again as quickly as the united force of the crew could do it; yet, in that very short time, the Sharks had devoured every part but the feet, which were secured by the end of the cord.

Persons, while swimming, have often been seized and devoured by the Sharks. The late Sir Brooke Watson was, some years ago, swimming at a little distance from a ship, when he saw a Shark making towards him. Struck with terror at its approach, he immediately cried out for assistance. A rope was instantly thrown; and even while the men were in the act of drawing him up the ship's side, the monster darted after him, and, at a single snap, tore off his leg.

In the pearl-fisheries of South America, every negro, in order to defend himself against these animals, carries with him into the water a sharp knife, which, if the fish offers

to assault him, he endeavours to strike into its belly; on which it generally swims off. The officers who are in the vessels, keep a watchful eye on these voracious creatures; and, when they observe them approach, shake the ropes fastened to the negroes, in order to put them on their guard. Many, when the divers have been in danger, have thrown themselves into the water, with knives in their hands, and hastened to their defence: but too often all their dexterity and precaution have been of no avail.

We are told, that in the reign of queen Anne, a merchant ship arrived at Barbadoes from England, some of the men of which were one day bathing in the sea, when a large Shark appeared, and sprung forward directly at them. A person from the ship called out to warn them of their danger; on which they all immediately swam to the vessel, and arrived in perfect safety, except one poor fellow, who was cut in two by the Shark, almost within reach of the oars. A comrade and most intimate friend of the unfortunate victim, when he observed the severed trunk of his companion, was seized with a degree of horror, that words cannot describe. The insatiable Shark was seen traversing the bloody surface in search of the remainder of his prey, when the brave youth plunged into the water, determining either to make the Shark disgorge, or to be buried himself in the same grave. He held in his hand a long and sharp-pointed knife, and the rapacious animal pushed furiously towards him: he had turned on his side, and opened his enormous jaws, in order to seize him, when the youth, diving dexterously under, seized him with his left hand, somewhere below the upper fins, and stabbed him several times in the belly. The Shark, enraged with pain, and streaming with blood, plunged in all directions in order to disengage himself from his enemy. The crews of the surrounding vessels saw that the combat was decided; but they were ignorant

which was slain, until the Shark, weakened at length by loss of blood, made towards the shore, and along with him his conqueror; who, flushed with victory, pushed his foe with redoubled ardour, and, with the aid of an ebbing tide, dragged him on shore. Here he ripped up the bowels of the animal, obtained the severed remainder of his friend's body, and buried it with the trunk in the same grave.—This story, however incredible it may appear, is related in the History of Barbadoes, on the most satisfactory authority.

The West India negroes often venture to contend with the Shark in close combat. They know his power to be limited by the position of his mouth underneath; and, as soon as they discover him, they dive beneath, and, in rising, stab him before he has an opportunity of putting himself into a state of defence. Thus do boldness and address unite in triumph over strength and ferocity.

The South Sea islanders are not in the least afraid of the Sharks, but will swim among them without exhibiting the least signs of fear. "I have seen," says Captain Portlock, "five or six large Sharks swimming about the ship, when there have been upwards of a hundred Indians in the water, both men and women: they seemed quite indifferent respecting them, and the Sharks never offered to make an attack on any of them, and yet at the same time would seize our bait greedily; whence it is manifest that they derive their confidence of safety from their experience, that they are able to repel the attacks of those devouring monsters."

An Indian, on the coast of California, on plunging into the sea, was seized by a Shark; but, by a most extraordinary feat of activity, cleared himself, and, though considerably wounded, threw blood and water at the animal, to show his bravery and contempt. But the voracious monster seized him with horrid violence a second time, and in a moment dragged him to the bottom. His com-

panions, though not far from him, and much affected by the loss, were not able to render him any assistance whatever.

We are told that, notwithstanding the voracity of these creatures, they will not devour any feathered animal that is thrown overboard; but that they will readily take a bait of a piece of flesh fastened on an iron crook. They are so tenacious of life, as to move about long after their head is cut off.

Their flesh is sometimes eaten by sailors on long voyages; and, though exceedingly coarse and rank, it is generally thought better than that of any others of the tribe. The skin is rough, hard, and prickly; and, when properly manufactured, is used in covering instrument cases, under the name of *shagreen.*

THE BASKING SHARK *.

This species has derived its name from its propensity to lie on the surface of the water, as if to bask itself in the sun. It possesses (though a very large fish) none of the voracity and ferociousness that mark the generality of the

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* DESCRIPTION. Its body is slender, and from three to twelve yards in length, of a deep lead colour above, and white below. The upper jaw is blunt at the end, and much longer than the lower. The mouth is placed beneath, and furnished with small teeth; those before much bent, and the remote ones conical and sharp-pointed. On each side of the neck there are five breathing apertures. There are two dorsal, two pectoral, two ventral fins, and one small anal fin. Within the mouth, near the throat, is a short kind of whalebone.

SYNONYMS. Squalus maximus. *Linn.*—Le Squale très-grand. *La Cepede.*—Sun-fish. *Smith's Hist. Cork.*—*Penn. Brit. Zool. vol.* iii. *tab.* 13.

Shark tribe. It will frequently lie motionless on the surface of the water, generally on its belly, but sometimes on its back; and it seems so little afraid of mankind, as often to suffer itself to be patted and stroked.

The Basking Sharks frequent our seas during the warm summer months, and are not uncommon on the Welsh and Scottish coasts, coming in shoals usually after intervals of a certain number of years. In the intervening summers, those that are seen on the Welsh coast, are generally single fish, that have probably strayed from the rest. They appear in the Firth of Clyde, and among the Hebrides, about midsummer, in small droves of seven or eight, or more commonly in pairs. Here they continue till the latter end of July, when they disappear.

Their food seems to consist entirely of marine plants, and some of the species of medusæ. They swim very deliberately, and generally with their upper fins above water. Sometimes they may be seen sporting about among the waves, and leaping several feet above the surface.

The liver is of such immense size, as frequently to weigh nearly a thousand pounds. From this a great quantity of good oil is extracted; which renders this Shark an animal of considerable importance to the Scotch fishermen: for, according to Anderson, the oil of a single fish will sometimes sell for twenty or thirty pounds sterling.

The natives of our northern coasts are very alert in the pursuit, and very dexterous in the killing, of these fish. When pursued, they do not accelerate their motion, till the boat comes almost in contact with them, when the harpooner strikes his weapon into the body, as near the gills as he can. They seem not very susceptible of pain; for they often remain in the same place, till the united strength of two men is exerted to force the harpoon deeper. As soon as they perceive themselves wounded, they plunge headlong to the bottom; and frequently coil the rope

round their bodies in agony, attempting to disengage themselves from the fatal instrument, by rolling on the ground. Discovering that these efforts are in vain, they swim off with such amazing rapidity, that one instance has occurred of a Basking Shark towing to some distance a vessel of seventy tons burthen, against a fresh gale. They sometimes run off with two hundred fathoms of line, and two harpoons in them; and will employ the men from twelve to twenty-four hours before they are subdued.

As soon as they are killed, the fishermen haul them on shore; or, if at a distance from land, to the vessel's side, to cut them up and take out the liver, which is the only useful part of their bodies. This is melted into oil, in kettles provided for the purpose; and, if the fish is a large one, it will yield eight barrels or upwards.

THE COMMON DOG-FISH *.

So excessively voracious are these animals, that they are altogether fearless of mankind. They follow vessels with great eagerness, seizing with avidity every thing eatable that is thrown overboard; and they have sometimes been known to throw themselves on fishermen, and on persons bathing in the sea. As, however, they are smaller and more weak than most other sharks, they do not attack their more exposed enemies by open force. In combating them, it is necessary to have recourse to stratagem. They, consequently, for this purpose, conceal themselves in the mud, and lie in ambush, like the rays, until they have an opportunity of acting offensively with success. Their

* SYNONYMS. Squalus canicula. *Linn.*—La Rousette tigrée. *Bloch.*—Spotted Dog-fish. *Pennant.*—Greater Cat-fish. *Edwards.* —Rough Hound, in Scotland.

usual food consists of fish and other marine animals, of which they destroy immense numbers.

On the coasts about Scarborough, where the Haddocks, Cod, and Dog-fish are in great abundance, the fishermen universally believe, that the Dog-fish make a line or semicircle, to encompass a shoal of haddocks and cod, confining them within certain limits near the shore, and eating them as occasion requires. For the haddocks and cod are always found near the shore, without any Dog-fish among them, and the Dog-fish farther off, without any haddocks or cod; and yet the former are known to prey upon the latter, and, in some years, devour such immense quantities, as to render this fishery more expensive than profitable.

These fish are found in the seas of all climates, both hot and cold: they equally abound on the coasts of Great Britain, Norway, the Cape of Good Hope, and the Canary Islands; and of those countries which lie immediately under the equinoctial line.

Their flesh is hard and disagreeable to the taste, diffusing also a strong odour, which somewhat resembles that of musk. Their dried skins constitute the well-known article of commerce, called *shagreen*, or the *skin of the Dog-fish*. The small and hard tubercles with which these are covered, render them highly useful in the polishing of wood, ivory, and even of iron. A considerable quantity of oil may be extracted from the livers of Dog-fish.

OF THE RAY TRIBE.*

The Rays are entirely confined to the sea; and, from being destitute of an air-bladder to buoy them, they live

* The bodies of these fish are broad, thin, and flat. The mouth is situated beneath, and the eyes above the body. The breathing apertures are five on each side, a little below the mouth. The head in general is small and pointed, and not distinct from the body.

altogether at the bottom, chiefly in deep water. They live on shell-fish, or any animal substances whatever that come in their way. Some of them become of a size so large, as to weigh two hundred pounds and upwards; in which case they are sometimes dangerous enemies to man, whom they are said to destroy by getting him down, lying upon, and devouring him. They seldom produce more than one young one at a time. This, as in the Sharks, is enclosed in a four-cornered bag or shell, which ends in slender points; but which does not (as in those) extend into long filaments. The liver is large, and often produces a great quantity of oil.

In their fresh state, most of the Rays have a fetid and unpleasant smell, but nearly the whole are eatable. There are about *twenty* species. Those with which we are best acquainted, are the Skate, the Thornback, and the Torpedo, or Electric Ray.

THE TORPEDO, OR ELECTRIC RAY*.

Torpedos are partial to sandy bottoms, in about forty fathoms of water, where they often bury themselves by flinging the sand over them, by a quick flapping of all the

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* Description. These fish, which are sometimes so large as to weigh betwixt seventy and eighty pounds, are nearly of a circular form, two or three inches thick in the middle, and attenuating to extreme thinness on the edges. The skin is smooth, of a dusky brown colour above, and white underneath. The ventral fins form on each side, at the end of the body, nearly a quarter of a circle. The tail is short, and the two dorsal fins are placed near its origin. The mouth is small, and, as in the other species, there are on each side below it five breathing apertures.

Torpedos are found in most of the European seas, and are by no means uncommon on the British coasts.

Synonyms. Raia Torpedo. *Linn.*—Torpedo, Cramp-fish. *Will.*

extremities. In Torbay they are generally caught like other flat-fish, with the trawl-net; and instances have occurred of their seizing a bait.

This fish possesses the same property of benumbing its prey, as that which I have before described in the electric eel: and, when it is in health and vigour, the shock that it communicates is very severe: but its powers always decline as the animal declines in strength, and when it expires, they entirely cease. In winter these are also much less formidable than during warm weather.

Dr. Ingenhousz had a Torpedo for some time in a tub of sea-water, which, from its being during winter, seemed to be feeble. On taking it into his hands, and pressing it on each side of the head, a sudden tremor, which lasted for two or three seconds, passed into his fingers, but extended no further. After a few seconds, the same trembling was felt again; and again several times, after different intervals. The sensation was, he says, the same that he should have felt by the discharge of several small electrical bottles, one after another, into his hand. The shocks sometimes followed each other very quickly, and increased in strength towards the last. Probably, from the weakness of the fish, the shock could not be communicated through a brass chain, though the usual contortion was evidently made. A coated vial was applied to it, but could not be charged.

From some experiments that were made by Mr. Walsh, on a very stout and healthy fish, it appears that, although it seemed to possess many electric properties, yet no spark whatever could be discovered to proceed from it, nor were pith-balls ever found to be affected by it. When it was

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Ich.—Electrical Ray. *Penn.*—La Torpille. *Bloch.*—La Raie Torpille. *La Cepede.*—Poule de Mer, Tremoise, in some parts of France.—*Penn. Brit. Zool. vol.* iii. *tab.* 10.

insulated, it gave a shock to persons likewise insulated, and even to several that took hold of each other's hands: this it did forty or fifty times successively, and with very little diminution of force. If touched only with one finger, the shock was so great, as to be felt in both hands. Each effort was accompanied by a depression of the eyes, which plainly indicated the attempts that were made upon non-conductors. Although the animal was in full vigour, it was not able to force the torpedinal fluid across the minutest tract of air, not even from one link of a small chain freely suspended to another, nor through an almost invisible separation made by a pen-knife in a slip of tin-foil pasted on sealing-wax.

The properties of this fish have been described by Oppian; but, with that liberty to which poets always conceive themselves entitled, he has endowed it with the power of benumbing the fishermen through the whole length of his line and rod.

> The hook'd Torpedo ne'er forgets his art,
> But soon as struck, begins to play his part;
> And to the line applies his magic sides:
> Without delay the subtile power glides
> Along the pliant rod and slender hairs,
> Then to the fisher's hand as swift repairs:
> Amaz'd he stands, his arms of sense bereft,
> Down drops the idle rod, his prey is left:
> Not less benumb'd than had he felt the whole
> Of frost's severest rage beneath the Arctic pole.

In the general structure of its body, the Torpedo has not been found to differ materially from the rest of the Rays. The electric organs are placed one on each side of the cranium and gills, reaching from thence to the semicircular cartilages of each great fin, and extending longitudinally from the anterior extremity of the animnl to the transverse cartilage which divides the thorax from the ab-

domen: and within these limits they occupy the whole space between the skin of the upper and under surfaces. Each organ is attached to the surrounding parts by a close cellular membrane, and also by short and strong tendinous fibres, which pass directly across from its outer edge to the semicircular cartilages. They are covered above and below with the common skin of the animal, under which there are longitudinal fibres spread entirely over them. Each organ is about five inches in length, and at the anterior end about three in breadth. They are composed of perpendicular columns, reaching from the upper to the under surface, varying in length according to the thickness of the parts of the body, from an inch and a half to half an inch; and their diameters are from a fourth to a fifth of an inch.

The coats of the columns are very thin, and almost transparent. The number of columns in each organ varies considerably in different animals. That of one which Mr. Hunter presented to the Royal Society was about 470; but in a very large Torpedo, the number of columns in one organ was 1182. These columns were composed of films parallel to the base of each, and the distance between each of the columns was the 150th part of an inch. If we suppose these films to be charged with electricity, and to be the 300th part of an inch thick, and a middling-sized Torpedo to contain in both organs, on the whole, 1000 columns each an inch long, and 0.03 square inches area at the base, then $1000 \times 150 \times 0.3 = 4500$ square inches. Now it has been clearly proved that the capacity of stout glass is thirty-six times less than that of these organs; therefore both the organs of a middling-sized Torpedo will be equivalent to $4500 \times 36 = 162{,}000$ square inches, or 1125 square feet of glass.—The nerves inserted into each organ arise by three very large trunks from the lateral and posterior part of the brain.—These, having entered the

organs, ramify in every direction between the columns. The number and magnitude are extremely great; and it is supposed that they are subservient to the formation, collection, and management of the torpedinal fluid.

The Torpedo brings forth its young ones in the autumn.

THE SKATE * AND THORNBACK †.

The Skate is the largest, and at the same time the most useful fish of its tribe. Its flesh is white, firm, and good. In some parts of the Continent, where these fish are caught in great abundance, they are dried for sale. The best season for Skate is the spring of the year. They sometimes attain a very large size. Willughby speaks of one so huge, that it would have served a hundred and twenty men for dinner.

From the month of May until the beginning of September, the females are occupied in producing their offspring. This they usually do on coasts and in places where they are liable to little interruption. Each of the young ones is enclosed in an oblong, angular bag, about half an inch thick in the middle. These are called *purses* by the fishermen. After the fish have escaped, the empty bags are

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* DESCRIPTION. The principal difference between the Skate and the Thornback, consists in the former having sharp teeth, and a single row of spines upon the tail; whilst the latter has blunt teeth, and several rows of spines both upon the back and tail.

SYNONYMS. Raia batis. *Linn.*—La Raie bates. *La Cepede.*—La Rai cendreé. *Bloch.*—Flassade, Couverture, Vachemarine, in some parts of France.—Skate, or Flaire. *Willughby.*—*Penn. Brit. Zool. vol.* iii. *tab.* 9.

† SYNONYMS. Raia clavata, *Linn.*—La Raie bouclée. *La Cepede. Bloch.*—Raie clouée, Clavelade, in some parts of France.—*Penn. Brit. Zool. vol.* iii. *tab.* 11, 12.

frequently cast ashore by the tide; and they are very common on all our coasts.

Dr. Monro has remarked, that in the gills of a large Skate there are upwards of 144,000 subdivisions, or folds; and that the whole extent of this membrane, whose surface is nearly equal to that of the whole human body, may be seen, by a microscope, to be covered with a net-work of vessels, that are not only extremely minute, but exquisitely beautiful.

In all its habits the *Thornback* resembles the Skate, except as to the time in which its offspring are produced. This is usually about the months of June and July; and during this time these fish are caught in great nnmbers.

A Thornback is mentioned by Bloch to have been caught near the island of St. Christopher, in the year 1634, which measured twelve feet in length, and nearly ten in width.

The flesh of the Thornback is inferior to that of the Skate. It is sometimes eaten in England, but generally sells at a low price. The young ones, however, which have the denomination of *Maids*, are reckoned delicate eating. The Norwegian fishermen catch the Thornbacks principally on account of their livers, from which they extract a considerable quantity of oil.

THE STING RAY, OR FIRE-FLAIRE*.

The ancient naturalists have described the caudal spine of this fish as a most alarming and terrible weapon. Ælian and Pliny each declare, that any person wounded

* Description. The Sting-ray is nearly of a round shape. Its body is smooth; and its nose sharp-pointed. The mouth is small, and furnished with blunt, or granulated teeth. The upper parts are of a dingy yellow, but somewhat lead-coloured towards the middle,

by it will certainly die; asserting that there is no medicine sufficiently powerful to effect a recovery. Oppian goes further, and pretends that its venom will even dissolve stone.

Of all the ills that art from nature steals,
That seas produce, or earth's dark womb conceals,
None equal that the ray-like Fire-flaire bears;
No dreaded stroke, no killing wound like hers.
All things must yield; the dire infection's such,
The solid flint would moulder at the touch.

This spine, in the tail of the Fire-flaire, is its weapon of offence when seized upon or attacked; and the serrated processes along its edges frequently make a bad, sometimes a dangerous wound. Violent inflammations have been known to succeed, attended, according to some writers, with convulsions; but these, it is presumed, were rather the consequence of the person wounded being in a bad habit of body, than of any poison conveyed into the wound by the spine. Those naturalists who have accurately examined the spine, assert that it has no vessel whatever capable either of secreting or of containing any such fluid; nor has the spine itself any passage capable of conducting a fluid into the wound.

With this spine it is probable that the Fire-flaire not only wounds its enemies, but those animals likewise which are destined for its food.

The Fire-flaire's tail the venom'd shaft contains,
Nor time nor waste the poisonous treasure drains;
Murderous alike they ravage all the sea,
First give the mortal wound, then seize the prey.

The tail tapers to a slender point, and has, on one side, a sharp, brown and serrated spine.

SYNONYMS. Raia pastinaca. *Linn.*—La Raie pastenaque. *La Cepede.*—La Pastenaque. *Bloch.*—Tareronde, in some parts of France.

*OF THE LAMPREY TRIBE**.

The bodies of these fish are slippery and mucous. Three of the species are inhabitants exclusively of fresh waters, and one only is known to frequent the sea. They are all much esteemed as food. So tenacious are they of life, that they will even continue firmly attached, by their mouths, to solid bodies, for some time after they are cut in half. They feed on worms, insects, small fish, and mud, or aquatic plants.

THE TRUE LAMPREY †, AND LESSER LAMPREY ‡.

The very surprising faculty of adhesion to solid bodies, in these fish, arises from their drawing up the middle of their circular mouth, and thus exhausting the air from under it. The edges of the mouth are thus pressed closely down to the object, by the weight of the super-incumbent atmosphere.

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* The head is more slender than the body, and the mouth longer above than beneath. The teeth are of an orange colour, hollow within, and surrounded with a fleshy margin. There are seven breathing apertures, or spiracles, on each side of the neck; and on the nape there is a fistulous opening. These fish have no pectoral or ventral fins.

† DESCRIPTION. The true Lampreys sometimes weigh so much as four or five pounds. In the mouth there are from twelve to twenty circular rows of teeth. The second dorsal fin is distinct from the tail. The body is dusky, and irregularly marked with dingy yellow or blue.

SYNONYMS. Petromyzon marinus. *Linn.*—La Lamproie proprement dite. *La Cepede. Bloch.—Penn. Brit, Zool. vol.* iii. *tab.* 8.

‡ DESCRIPTION. These fish seldom exceed the length of ten or twelve inches. On each side of the upper part of the mouth there are three rows of very minute teeth, and on the lower part there are

Possessed of an apparatus so formidable as the mouth of the True Lamprey, this fish, although it feeds on animal substances, does not attack the larger and more powerful inhabitants of the water. It usually preys on marine worms and small fish; and, like the eel, will even content itself with the flesh of dead and putrid animals. In fact, the teeth, from the circumstance of their not being fixed in bony jaws, are incapable of offensive operations against animals more powerful than themselves.

The branchial orifices, or gills, on each side of the neck of the Lamprey, are mistaken by many persons for eyes. This fish is destitute of bones, having only strong cartilages in place of them.

Although the True Lampreys are found in several of our large rivers, they are sea-fish. They, however, quit the salt water about the commencement of spring; and after continuing in the rivers for a few months, return again to the ocean. The season during which they are in highest perfection for the table, is from the beginning of March until about the end of May. Their flesh is stated to be most firm when they first enter the rivers; and that, after they have been some time in the fresh water, it wastes and becomes flabby.

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seven teeth. The second dorsal fin is angulate. The upper parts of the body are brown or dusky, sometimes mixed with blue; and the under parts silvery.

SYNONYMS. Petromyzon fluviatilis. *Linn.*—Le Petromyzon pricka. *La Cepede.*—La Petite Lamproie. *Bloch.*—*Penn. Brit. Zool. vol.* iii. *tab.* 8.

INSECTS *.

Coleopterous Insects †.

OF THE SCARABÆUS OR BEETLE TRIBE ‡.

The larvæ or grubs of these insects have each six feet. In their general appearance they are not much unlike the caterpillars of some of the butterflies, having their bodies composed of rings, and being somewhat hairy. Most of them live entirely under the surface of the ground, feeding on the roots of plants, &c. Their *pupa*, or *chrysalis*, generally lies dormant in the earth till the perfect insect bursts out.

Beetles inhabit and feed in various situations Some are found in the dung of animals, or in the earth immediately under the dung. Others live on the leaves of trees; and others on flowers.

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* For an account of the Insects in general, see vol. i. p. 41.

† The insects of the Linnæan order *Coleoptera* have crustaceous elytra or wing-cases, which shut together and form a longitudinal suture down the back.

‡ The antennæ of the Beetles have a clavate or enlarged extremity, which is divided into lamellæ or leaves. To the mouth there are four palpæ or feelers. The feet have each five joints; and the shanks of the fore-legs are generally toothed.

THE BULL-COMBER *, CLOCK BEETLE †, AND SPRING BEETLE ‡.

These insects are all nourished, both in their larva and perfect state, in the dung of animals, which they are able to discover by their acute faculty of smell, or otherwise, at an immense distance. Under these substances they dig, in the earth, cylindrical holes, of considerable depth, in which they deposit their eggs.

They usually fly in the evening, towards the end of twilight. The droning noise produced by their wings, at that time, is often heard, particularly during the summer season. When touched, these insects counterfeit death; but they do not contract their legs, in the manner of the Dermestes, and some other Beetles: they stretch them out, so as to give the appearance of stiffness and rigidity, as though the animals had been some time dead.

All these insects are subject to be infested with a species of *acarus*, or tick, sometimes in such numbers that they are

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* DESCRIPTION. The thorax of this Beetle has three horns, of which the middle one is the smallest, and the lateral ones are nearly as long as the head. The elytra or wing-cases are striated. The whole insect is of a shining black colour.

SYNONYMS. Scarabæus typhæus. *Linnæus. Fabricius.*—Geotrupe phalangiste. *Latreille.*

† DESCRIPTION. The thorax and head are unarmed. The shield is rhombic; and the crown somewhat prominent. The body is black, and the elytra are striated.

SYNONYMS. Scarabæus stercorarius. *Linn.*—Géotrupe stercoraire. *Latreille.*—Le Grand Pilulaire. *Geoffroy.*

‡ DESCRIPTION. The thorax and head are unarmed. The elytra are without streaks or punctures. The shield is rhombic; and the crown a little prominent. The general colour is a brilliant black.

SYNONYMS. Scarabæus vernalis. *Linn.*—Geotrupe printanier. *Latreille.*—Le Petit Pilulaire. *Geoffroy.*

scarcely able to walk, in consequence of these crowding closely round the joints of the legs and thighs. A German writer states, that the females of that country used formerly to employ the thighs of some of the most brilliant of these Beetles, in the ornamental parts of their head-dress.

THE COCK-CHAFER*.

The eggs of the Cock-chafer are deposited in the ground by the parent insect, whose fore-legs are very short, and are well calculated for burrowing. From each of these eggs proceeds, after a short time, a whitish worm with six legs, a red head, and strong claws, and about an inch and a half long, which is destined to live in the earth under that form for four years, and there undergo various changes of its skin, until it assumes its chrysalid form. It subsists, during its subterraneous abode, on the roots of trees and plants, committing ravages often of the most deplorable nature. These creatures, sometimes in immense numbers, work between the turf and the soil in the richest meadows, devouring the roots of the grass to such a degree, that the turf rises, and will roll up with almost as much ease as if it had been cut with a turfing-knife: and underneath, the soil appears turned into a soft mould for above an inch in depth, like the bed of a garden. In this the grubs lie, in a curved position, on their backs, the head and tail uppermost, and the rest of the body buried in the mould. Mr. Arderon, of Norwich, mentions his having seen a whole

* Synonyms. Scarabæus Melolontha. *Linn.*—Melolontha vulgaris. *Fabricius.*—Brown Tree Beetle, Blind Beetle, Chafer, Cock-chafer, Jack-horner, Jeffry-cock, May-bug, Tree Beetle, Brown Clock, Dor, in various parts of England. Millers, from their powdery white colour.—The Grub is called the Connaught worm in Ireland.

field of fine flourishing grass, in the summer time, become in a few weeks withered, dry, and as brittle as hay, by these grubs devouring the roots, and gnawing away all those fibres that fastened it to the ground, and through which alone it could receive nourishment.

The larvæ, as I have said, continue four years in the ground; and when, at the end of this period, they are about to undergo their change, they dig deep into the earth, sometimes five or six feet, and there spin a smooth case, in which they change into a *pupa* or chrysalis. They remain under this form all the winter, until the month of February, when they become perfect beetles, but with their bodies quite soft and white. In May the parts are hardened, and they then come forth out of the earth. This accounts for our often finding the perfect insects in the ground.

Cock-chafers fly in the evening towards sunset, and particularly about places where there are trees. They eat the leaves of the sycamore, the lime, the beech, the willow, and those of all kinds of fruit-trees. In its winged state this insect exhibits not less voracity on the leaves of trees, than it before did in its grub state in the earth; for, such is the avidity with which it devours its food, and so immense are sometimes the numbers, that, in particular districts, they have become an oppressive scourge, which has produced much calamity among the people.

In the year 1688, the Cock-chafers appeared on the hedges and trees of the south-west coast of the county of Galway, in clusters of thousands, clinging to each others' backs, in the manner of bees, when they swarm. During the day they continued quiet, but towards sun-set the whole were in motion; and the humming noise of their wings sounded like distant drums. Their numbers were so great, that, for the space of two or three square miles,

they entirely darkened the air. Persons travelling on the roads, or who were abroad in the fields, found it difficult to make their way home, as the insects were continually beating against their faces, and caused great pain. In a very short time the leaves of all the trees, for some miles round, were destroyed, leaving the whole country, though it was near midsummer, as naked and desolate as it would have been in the middle of winter. The noise which these enormous swarms made in seizing and devouring the leaves, was so loud as to have been compared to the distant sawing of timber. Swine and poultry destroyed them in vast numbers. These waited under the trees for the clusters dropping, and devoured such swarms as to become fat from them alone. Even the native Irish, from the insects having eaten up the whole of the produce of the ground, adopted a mode of dressing them, and used them as food. Towards the end of summer they disappeared so suddenly, that, in a few days, there was not a single one left.

About sixty years ago a farm near Norwich was so infested with Cock-chafers, that the farmer and his servants affirmed that they gathered eighty bushels of them; and the grubs had done so much injury, that the court of that city, in compassion to the poor fellow's misfortune, allowed him 25*l*.

Mouffet informs us, that in the month of February, 1574, there were such multitudes of them in the western parts of England, that those which fell into the river Severn completely clogged the water-wheels of the mills.

Rooks and gulls devour immense numbers of the grubs of this destructive insect, by which means they render a most essential service to mankind, and great care ought to be taken to cherish and protect them. The almost sole employment of rooks, for nearly three months in the spring of the year, is to search for insects of this sort for food; and

the havock that a numerous flock makes among them must be very great.

A cautious observer, having found a nest of five young jays, remarked that each of these birds, while yet very young, consumed at least fifteen full-sized grubs of the Chafer in a day; and averaging their sizes, it may be said that each consumed twenty: this for the five makes a hundred: and if we suppose the parents to devour between them the same number, it appears that the whole family consumed about two hundred every day. These, in three months, would amount to twenty thousand. But as the grub continues in the same state for four years, this single pair, with their family alone, without reckoning their descendants after the first year, would destroy as many as eighty thousand grubs. Now, supposing that forty thousand of these may be females, and that each female lays, as is the case, about two hundred eggs, it will appear that no less than *eight millions* of grubs have been destroyed, or at least prevented from being hatched, by this single family of jays.

It is true, that in these labours of the rooks, jays, and some other birds, they sometimes do mischief to man; yet there can be little doubt, that the damage they thus commit is amply repaid by the benefit that results from these their unceasing exertions.

Some farmers plough the ground in order to expose the grubs to the birds; and others take the pains to dig deeper, wherever the rooks point them out by their attempts to reach them.—When the insects are in their winged state, to shake the trees at noon, when they are all either asleep or in a state of inactive stupor, and gather or sweep them up from the ground, seems the most eligible method. One person has been known to kill in a day, by this method, above a thousand: by which, though in so short a space of

time, at a fair calculation, he prevented no fewer than a hundred thousand eggs from being laid.

The dead bodies of these insects afford a very acceptable food to ducks, turkies, and other poultry. Swine, as I have before observed, will likewise greedily devour them, particularly when bruised and mixed with their other food *; and cats catch and eat them with great avidity.

A person near Blois, in France, employed, in the year 1785, a number of children and poor persons, to destroy the Cock-chafers, at the rate of two liards a hundred. In a few days fourteen thousand were brought to him. Thus, for the moderate sum of about seven shillings and eightpence sterling, he destroyed, according to his calculation, nearly a *million and a half* of the grubs; which, had they been allowed to be hatched, might, in the course of four years, have done damage to the amount of many thousand pounds.

THE ROSE-CHAFER †.

There are scarcely any of the English Chafers more beautiful than this. The upper parts of the female are of a shining green colour, marked transversely on the wing-cases with a few short white or yellowish lines. The male is of a burnished copper colour, with a greenish cast. These insects are somewhat more than an inch in length. They are found on flowers, particularly on those of the rose and peony.

The grubs that produce this beetle feed underground,

* It is, however, said, that when swine have once been fully satiated with them, they never care for them afterwards.

† SYNONYMS. Scarabæus auratus. *Linn.*—Cetonia aurata. *Fabricius.*—Rose May Chafer, Green Beetle, and Brass Beetle, in some parts of England.

most commonly at the roots of trees, and never appear on the surface unless disturbed by digging, or some other accident. They are thought to be injurious to the gardener, by devouring the roots of his plants and trees. The female deposits her eggs in the middle of June. For this purpose she burrows into soft, light ground, hollowing out and forming for them a proper receptacle. When the operation is over, she returns to the surface and flies off, but seldom lives more than two months afterwards. The grubs are produced in about fourteen days, and immediately seek out for food, which the parent always takes care to have near the place where she lays her eggs. As soon as they have attained sufficient strength, the young grubs separate, each burrowing in a different direction, in search of roots. They remain four years in this state, annually changing their skin till they become of full growth, when they are of a cream colour, with brown head and feet. During winter they eat but little, if at all, and retire so deeply into the ground as to avoid the effects of the frost.

About the month of March, at the end of the fourth year, the grub forms a case of earth, about the size of a walnut, somewhere near the surface, within which it changes into a chrysalis. In this state it remains till the beginning of May, when it bursts out a perfect Chafer. This is at first of a light green colour, aad very tender; but it soon acquires its proper hardness and strength.

When the insect is touched it emits a fetid moisture, which, no doubt, is a mode of defence against the attacks of its enemies.

THE PILL CHAFER *.

In its habits of life the Pill Chafer is one of the most remarkable of the Beetle tribe. It comes forth in April, and

* DESCRIPTION. This insect is somewhat more than an inch in length, and of a dusky black colour, sometimes with a greenish hue

is to be seen abroad until about September, when it disappears. Its almost constant employment, in which indeed it is indefatigable, is in the different operations necessary to continue its species. It provides a proper nidus for its eggs, by forming round pellets of dung, in the middle of each of which it deposits an egg. These, in September, the insects convey to the depth of about three feet into the ground. Here they remain till the approach of spring, when the grubs burst their shell, and find their way to the surface of the earth.

"I have attentively admired their industry, and their mutually assisting of each other (says Catesby) in rolling these globular balls from the place where they made them, to that of their interment, which is usually the distance of some yards, more or less. This they perform breech foremost, by raising their hind parts, and forcing along the ball with their hind feet. Two or three of them are sometimes engaged in trundling one ball, which, from meeting with impediments, on account of the unevenness of the ground, is sometimes deserted by them. It is, however, attempted by others with success, unless it happen to roll into some deep hollow or chink, where they are constrained to leave it; but they continue their work by rolling off the next ball that comes in their way. None of them seem to know their own balls, but an equal care for the whole appears to affect all the community. They form these pellets while the dung remains moist; and leave them to harden in the sun before they attempt to roll them. In their

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above, and underneath of a very brilliant blue or green. The wing-cases and thorax are very smooth; the former marked with several longitudinal streaks, and the latter round, and margined, having a slight groove in the middle.

It is found both in Europe and America.

SYNONYMS. Scarabæus pilularius. *Linn.*—Ateuchus pilularius. *Fabricius.*—Tumble-dung Beetle. *Brickell.*

moving of them from place to place, both they and the balls may frequently be seen tumbling about over the little eminences that are in their way. They are not, however, easily discouraged; and, by repeating their attempts, usually surmount the difficulties."

Catesby says also that "they find out their subsistence by the excellency of their *noses*," which direct them in their flight to newly-fallen dung, on which they immediately go to work, tempering it with a proper mixture of earth. So intent are they always upon their employment, that, though handled or otherwise interrupted, they are not to be deterred, but, immediately on being freed, persist in their work without any apprehension of danger.

They are said to be so exceedingly strong and active, as to move about, with the greatest ease, things that are many times their own weight. Dr. Brickell was supping one evening in a planter's house of North Carolina, when two of them were conveyed, without his knowledge, under the candlesticks. A few blows were struck on the table, and to his great surprise the candlesticks began to move about, apparently without any agency; and his surprise was not much lessened, when, on taking one of them up, he discovered that it was only a Chafer that moved it.

Professor Thunberg and Mr. Brown both mention the operations of a species Chafer in the different parts of Africa that they visited, which agree in every respect with those of the present species. We have also one in our own country, *Scarabœus lunaris*, whose manners are nearly the same.

Aristophanes, in his Ειρηνη, has introduced one of the Dung-Chafers, on which a character in the play mounts up to Jupiter, to petition for peace.

OF THE LUCANUS OR STAG-BEETLE TRIBE.

The antennæ of the Stag Beetles have a clavate extremity, divided into short, comb-like leaves. The jaws are toothed, and extend so far beyond the head, as to resemble horns. Under the lip there are two palpi or feelers, so thickly covered with hair, as to appear like tufts.

These insects are chiefly found in rotten and half decayed wood, and under the bark of trees.

THE GREAT STAG-BEETLE *.

In some parts of the south of England, these insects are very common in the oak and willow trees: in the stumps or about the branches of which they remain hidden during the day; flying abroad and feeding on the leaves only in the evening. The month of July is the time during which they are principally seen. The males, in particular, have great strength in their mandibles or jaws. With these they are able to pinch very severely. Linnæus informs us, that they feed on the liquor that oozes from the trunks or branches of trees; and it has been conjectured that the jaws are used either in obtaining their

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* Description. This is the largest of any insect found in Great Britain, measuring sometimes nearly three inches from the points of its jaws to the extremity of the abdomen. Its colour is entirely dark brown, except the jaws, which are sometimes as red as coral, and give to it a very beautiful appearance: by these, which somewhat resemble in form the horns of the stag, it is readily distinguished from all other insects.

Synonyms. Lucanus cervus. *Linnæus.*—Lucane Cerf-volant, *Latreille.*—Le grand Cerf-volant, in France.

food, or in fixing themselves firmly to the spot while they eat. It said that Stag-Beetles may be kept alive for a considerable time, by supplying them with the fresh leaves of oak or willow, or with sweetened water.

In Germany there is a popular notion, that these insects are sometimes known to take burning coals into the houses, by means of their jaws; and that, in consequence of this, dreadful fires have been occasioned.

It is a singular circumstance with respect to these insects, that I have frequently found several of their heads near together, and all perfectly alive, while the trunks and abdomens were no where to be seen: sometimes only the abdomens were gone, and the heads and trunks were left together. How this circumstance took place, I never could discover with any certainty. An intimate and intelligent friend of mine supposes, however, that it must have been in consequence of the severe battles which at times take place among these, the fiercest of the insect tribes: but their mouths not seeming formed for animal food, he is at a loss to guess what becomes of the abdomens. They do not fly until most of the birds have retired to rest, and indeed, if we were to suppose that any of these devoured them, it would be difficult to say why the heads or trunks alone should be rejected.

The females deposit their eggs in decayed or worm-eaten trees. The larvæ, which are round and whitish, with rust-coloured head and legs, are nourished upon the bark. In this state they pass six years. When about to undergo their change into a chrysalis, each insect forms a hard and solid ball, of the form of an egg, and sometimes as large as the hand. When the perfect insect issues forth, it is at first quite soft. Its parts, however, soon harden, and in a little while it is able to fly away.

OF THE DERMESTES TRIBE*.

In their perfect state, these insects are generally extremely timid. The moment they are threatened with danger, they stop in their course, draw up their antennæ and feet, and continue in a feigned state of death, until the object of their fear is removed.

The larvæ or maggots, subsist chiefly upon the bodies of dead animals, dried skins, the bark of trees, and old wood. Some of them are very destructive to books and furniture.

THE BACON DERMESTES†.

This insect, one of the most destructive of its tribe, is produced from a maggot, which is bred and nourished in bacon, or in other animal substances. To collections of dried and preserved animals, they are sometimes particularly injurious. They change their skins several times. These skins continue stretched out, as if blown up, and in appearance like the little animals which cast them.

In order to undergo their transformation, the larvæ search out some convenient retreat; generally finding one

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* The antennæ are club-shaped; the club perfoliate. The thorax is convex, and slightly margined. The head is inflected under the thorax.

† Description. The perfect insect is black, having the elytra or shells cinereous on the upper part.—The larvæ are elongated, the body diminishing insensibly before and behind; and terminating in a truncated cone. The skin is hard and leathery, of a brown colour above, and covered with long hair.—The *pupa* or *chrysalis* is white, with the eyes, and some transverse rays on the back yellowish.

Synonyms. Dermestes lardarius. *Linn.*—Le Dermeste du Lard. *Latreille.*

amongst the wreck of the substances which they have gnawed. They do not continue in their chrysalid form more than about three weeks or a month.

*OF THE PTINUS OR BORER TRIBE**.

In a larva state, these insects are chiefly found in the trunks of decayed trees, and in old wood, where they make holes as round as though they had been formed with a gimlet. They are nearly allied to the Dermestes, but differ from them in their antennæ, mandibles, and legs.

In the spring of the year, says Olivier, we see these insects issuing from wood where the *pupæ* have been enclosed; and, attracted by the rays of the sun, run along upon the window frames, beams, or wainscot. Like the Dermestes, they feign themselves to be dead when touched: burying their head under the thorax, drawing in the legs, and concealing entirely their antennæ between the head and upper borders of the thorax, they present only the appearance of an inanimate substance.

The devastations which their larvæ commit ought to fix our attention. Old moveables of wood, worm-eaten, and full of cylindrical holes, indicate, at the same time, the work and the habitations of these insects. By means of two strong and powerful jaws, they gnaw the wood on which they feed; and which, after passing through their bodies, is deposited in small grains of very fine powder, which fills up the holes behind them, as the little creatures pass onward. They increase their dwellings as they themselves increase in size; and when they have attained their

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* These insects have antennæ that are nearly of an equal thickness throughout; the last joints, however, in most of the species are somewhat larger than the rest. The thorax is nearly round unmargined, and contains the head.

full dimensions, they weave a nidus, of a kind of silk issuing from their body, in the bottom of their hole. In this they change to a pupa state, and afterwards to perfect insects.

There are numerous species, several of which are found in England. It will not be necessary for me to speak of more than one.

THE DEATH-WATCH PTINUS*.

Notwithstanding its smallness, this creature is often the cause of serious alarm among the superstitious, from the noise which it makes, at a certain season of the year, resembling the ticking of a watch. From this it has its name; for, whenever this faculty is exerted, it is esteemed portentive of death to some one of the family in the house where it is heard. The philosopher and the naturalist may smile at a notion thus absurd; yet Sir Thomas Brown has remarked, with great earnestness, that the man "who could eradicate this error from the minds of the people, would save from many a cold sweat, the meticulous heads of nurses and grandmothers."

> The wether's bell
> Before the drooping flock tolled forth her knell,
> The solemn Death-watch click'd the hour she died.

It is generally in the advanced state of spring, that these insects commence their noise, which is nothing more than a call or signal, by which they are mutually attract-

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* Description. The Death-watch is a dusky and somewhat hairy insect, with irregular brownish spots, about a quarter of an inch in length.

Synonyms. Ptinus tesselatus. *Linn.*—Anobium tesselatum. *Fabricius.*—Ptinus fatidicus. *Shaw's Nat. Mis.*

ed to each other; and it may be considered as analogous to the call of birds. This noise does not arise from the voice, but from the insect's beating on any hard substance with the shield or fore-part of its head. The general number of successive distinct strokes, is from seven to nine, or eleven. These are given in tolerably quick succession, and are repeated at uncertain intervals; and in old houses, where the insects are numerous, they may be heard, if the weather be warm, almost every hour in the day. The noise exactly resembles that made by beating with the nail on a table.

The insect being difficult to discover, from its obscure grayish brown colour, nearly resembling that of decayed wood, it is not always easy to say from what exact spot the sound proceeds. Mr. Stackhouse observed carefully the manner of its beating. He says, the insect raises itself on its hinder legs, and, with the body somewhat inclined, beats its head with great force and agility against the place on which it stands. One of them, on a sedge-bottomed chair, exerted so much force, that its strokes were impressed and visible in the exterior coat of the sedge, for a space equal to that of a silver penny. Mr. S. took this insect and put it into a box. On the following day he opened the box, and set it in the sun. It seemed very brisk, and crept about with great activity on the bits of sedge and rotten wood, till at last, getting to the end of the pieces, it extended its wings, and was about to take leave. He then shut down the lid, when it withdrew them and remained quiet. He kept it by him about a fortnight.

The idea of taming this little animal may appear absurd: it has, however, been so much familiarized, as to be made to beat occasionally. On taking it out of its confinement, and beating with the nail or the point of a pen on a table or board, it will answer the beats very

readily, and will even continue to repeat its efforts as long as it is required.

Dr. Derham kept a male and female together in a box for about three weeks; and, by imitating their noise, he made them beat whenever he pleased. At the end of this time one of them died; soon after which, the other gnawed its way out and escaped.

This insect, which is the real Death-watch of the vulgar, emphatically so called, must not be confounded with a wingless insect, not much unlike a louse, which makes a ticking noise like a watch, but which, instead of beating at intervals, continues its noise for a considerable length of time without intermission. The latter belongs to a tribe very different from this; it is the *Termes Pulsatorium* of Linnæus, and will be hereafter described.

OF THE SILPHÆ, OR CARRION BEETLES.

These insects are chiefly found, both in a perfect and larva state, in the half-decayed and putrid bodies of animals. Their smell is consequently fetid and disagreeable. Their antennæ are clavate, and the club is perfoliate. The elytra or wing-cases are margined; and the head is prominent. The thorax is somewhat flattened, and also margined.

THE BURYING SYLPH *.

The best account that I have met with of the habits and economy of these interesting insects, is from M. Gleditsch,

* Description. The body and the wing-cases of this insect are black; the latter with two ferruginous sinuate bands. The clubs of the antennæ are red.

It is found not only in England, but in almost every part of Europe.

Synonyms. Silpha vespillo. *Linn.*—Scarabæus silphoides?? *Pallas Ic. ins. Rass. p.* 11. *t.* A. *fig.* 11.—Le Fossoyeur, in France.

a well-known writer on natural history. This gentleman had, at different times, observed, that moles which had been left upon the ground after they had been killed, very unaccountably disappeared. He therefore was determined to ascertain by experiment, if possible, what could be the cause of this singular occurrence.

On the twenty-fifth of May, he accordingly obtained a dead mole, which he placed on the moist, soft earth of his garden, and in two days he found it sunk to the depth of four fingers' breadth into the earth: it was in the same position in which he had placed it, and its grave corresponded exactly with the length and breadth of its body. The day following, this grave was half filled up; and he drew out the mole cautiously, (which exhaled a horrible stench,) and found, directly under it, little holes, in which were four Beetles of the present species. Discovering at this time nothing but these Beetles, he put them into the hollow, and they quickly hid themselves among the earth. He then replaced the mole as he found it, and, having spread a little soft earth over it, left it without looking at it again for the space of six days. On the twelfth of June he again took up the same carcase, which he found in the highest state of corruption, swarming with small, thick, whitish worms, that appeared to be the family of the Beetles. These circumstances induced him to suppose that it was the Beetles that had thus buried the mole, and that they had done this for the sake of lodging in it their offspring.

Mr. G. then took a glass cucurbit, and half filled it with moist earth; into this he put the four Beetles with their young, and they immediately concealed themselves. This cucurbit, covered with a cloth, was placed on the open ground, and in the course of fifty days, the four Beetles interred the bodies of *four* frogs, *three* small birds, *two* grasshoppers, and *one* mole, besides the entrails of a fish, and two small pieces of the lungs of an ox.

Of the mode in which they performed this very singular operation, the following is an account: A linnet that had been dead six hours was placed in the middle of the cucurbit; in a few moments the Beetles quitted their holes, and traversed the body. After a few hours, one pair of the Beetles only was seen about the bird, the largest of which was suspected to be the female. They began their work by hollowing out the earth from under the bird. They arranged a cavity the size of the bird, by pushing all around the body the earth which they removed. To succeed in these efforts, they leaned themselves strongly upon their collars, and, bending down their heads, forced out the earth around the bird like a kind of rampart. The work being finished, and the bird having fallen into the hollow, they covered it, and thus closed the grave.

It appeared as if the bird moved alternately its head, its tail, its wings, or feet. Every time that any of these movements were observed, the efforts that the Beetles made to draw the body into the grave, which was now nearly completed, might be remarked: in effecting this, they jointly drew it by its feathers below. This operation lasted full two hours, when the smallest or male Beetle, drove away the female from the grave, and would not allow her to return, forcing her to enter the hole as often as she attempted to come out of it.

This Beetle continued the work alone for at least five hours; and it was truly astonishing to observe the great quantity of earth which he removed in that time: but the surprise of Mr. G. was much augmented, when he saw the little animal, stiffening its collar, and exerting all its strength, lift up the bird, make it change its place, turn, and, in some measure, arrange it in the grave that it had prepared; which was so spacious, and so far cleared, that he could perceive exactly under the bird, all the movements and all the actions of the Beetle.

From time to time, the Beetle, coming out of its hole, mounted upon the bird, and appeared to tread it down; then, returning to the charge, it drew the bird more and more into the earth, till it was sunk to a considerable depth. The Beetle, in consequence of this uninterrupted labour, appeared to be tired: leaning its head upon the earth, it continued in that position nearly an hour, without motion; and it then retired completely underground.

Early in the morning the body was drawn entirely underground, to the depth of two fingers' breadth, in the same position that it had when laid on the earth; so that this little corpse seemed as if it were laid out on a bier, with a small mount or rampart all round, for the purpose of covering it. In the evening the bird was sunk about half a finger's breadth deeper in the earth; and the operation was continued for nearly two days more, when the work obtained its final completion.

A single beetle was put into the glass cucurbit, with the body of a mole, and covered, as before, with a fine linen cloth. About seven o'clock in the morning, the Beetle had drawn the head of the mole below; and, in pushing the earth backward, had formed a tolerably high rampart around it. The interment was completed in this instance, by four o'clock in the afternoon, a space of time so short, that one could scarcely have imagined it possible, by so small a creature, without any assistance, considering that the body of the mole must have exceeded it in bulk and weight at least thirty times.

While engaged in these experiments, a friend, who wished to dry a toad in the shade, fixed it to a stick which he stuck into the ground. When it began to putrefy, the Beetles, allured by the smell, having loosened the end of the stick that was fixed in the earth, brought it to the ground, and they then interred both the toad and the stick.

The interment of these animals, which generally takes place from about the middle of April to the end of October, has been sufficiently proved to be not merely for food, but as a proper nidus for the eggs of the insects, and to nourish the young family of grubs that proceeds from them. If they wanted them for food only, they would no doubt consume them aboveground; but in the continuation of the species, it is necessary to have them below, since, otherwise, foxes, ravens, kites, and other carnivorous animals, would seize on the bodies, and, along with them, would swallow the grubs of the Beetles, and the whole species might thus be under the risk of extirpation.

OF THE COCCINELLA OR LADY-BUG TRIBE.

The principal food of these insects consists of aphides or plant-lice; by destroying which, in immense numbers, they render a most important service to mankind.

Their antennæ are club-shaped, and the club is solid. The thorax and elytra are margined. The body is hemispherical, and the abdomen flat.

The larvæ of some of the species, have their bodies covered with scaly plates; others have hairs on the upper parts of the body, and on the sides; and there are others still different.

THE SEVEN-SPOTTED *, AND TWO-SPOTTED LADY-BUG †.

Few insects are either more common or better known than these. They are usually found on plants, where

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* DESCRIPTION. The wing-cases are red, and marked with seven black dots.

SYNONYMS. Coccinella septem-punctata. *Linn.*—La Coccinelle

they repose with the legs concealed under their body, and their antennæ beneath the head. In the winter season they hide themselves and become torpid, and again appear abroad in the spring.

The females deposit their eggs on such plants as abound with aphides or plant-lice. The larvæ have each six feet, and a conical body divided into twelve rings. At the extremity of the posterior ring, there is a kind of fleshy teat, by which they are able to adhere to solid bodies, and firmly to support themselves while employed in seizing and devouring their food. They are so extremely voracious, that when other food is scarce, they will sometimes eat even their own species.

In order to change into their *pupa* state, they attach themselves by their fleshy feet, to the leaves or branches of trees. Here they drop a small quantity of glutinous liquor, which fixes them to the spot, and in a position contrary to that of the plane to which they adhere. Little by little their body contracts, and at the end of two or three days they undergo their transformation. In freeing themselves from their skin, they make it pass towards the hinder part of their body, where it continues like a little pellet.

The *pupæ* are beautifully spotted with black and other colours. The only motion observable in them, is that of alternately elevating and depressing their body, particularly if touched. They finally quit their envelope in

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sept points. *Tigny.*—Lady Cow, Lady Bird, and Cow Lady, in several parts of England.

† Description. The wing-cases are red, and marked with two black dots.

Synonyms. Coccinella bi-punctata. *Linn.*—La Coccinelle biponctuée. *Tigny.*

about six days after this last change. When they first come into the world as perfect insects, their wing-cases are of a yellowish white colour, soft and flexible. These soon harden by their contact with the external air; and shortly afterwards assume their proper spots and colours.

These insects in France have the name of *Bête à Dieu*, *Vache-à-Dieu*, and *Bête de la Vierge*.

OF THE CURCULIO OR WEEVIL TRIBE*.

The *larvæ* of the Weevils, like those of the other coleopterous insects, have six legs and a scaly head. They bear a resemblance to oblong soft worms. Some of them infest granaries, where, from their numbers and voracity, they often commit great ravages among the corn: some live in fruits, the insides of artichokes, thistles, and other plants; and others devour the leaves of trees and vegetables.

One division of the Weevils feed on trees and shrubs, inserting their beaks into the tender branches, and by this means extracting their juices. The *Curculio alliariæ* has been observed with its beak plunged into the twig of a crab-tree, as far as the place from whence the antennæ arise. Another division feed solely on plants. Others live on grain, wood, and on some of the species of fungi; and a few under the surface of the earth.

THE CORN WEEVIL †

Is well known to most farmers, from the devastations that it makes in their granaries. The parent insect lays

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* The Weevils have clavate antennæ seated on the snout, which is horny and prominent. They have also four thread-shaped feelers.

† Description. This insect is of a black-brown colour, and scarcely more than a tenth of an inch in length. Its snout is long

its eggs in grains of corn, probably one in each grain. Here the larvæ, on being hatched, continue for some time to live, and it is very difficult to discover them, as they lie concealed within. They increase their size, and with it their dwelling, at the expence of the interior or farinaceous parts of the grain on which they feed. Corn-lofts are often laid waste by these grubs, whose numbers are sometimes so great, as to devour nearly the whole of their contents. When the grub has attained its full size, it still remains within the grain, hidden under the empty husk. There, being transformed, it becomes a chrysalis; and, when it has attained its perfect state, it forces its way out.

It is no easy matter to discover by the eye the grains that are thus attacked, for, in external appearance, they are still large and full. If, however, they are thrown into water, their lightness soon detects them.

To rid a granary of these destructive insects, it has been recommended to farmers to spread their corn in the sun, when they will creep out of their holes; and, by often stirring the corn while in this situation, it is supposed they may be completely expelled. It is also said that they may be destroyed by strewing boughs of elder, or branches of henbane, among the corn. In a late Paris paper, a gentleman says, that about the month of June, when his granaries and barns, that had been much infested by Weevils, were all empty, he caused a number of the hills of the large ants to be collected in bags, and placed in different parts about them. The ants immediately attacked the Weevils that were on the walls and other parts, and destroyed them so completely, that in a very short

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and small; and the thorax is punctured, and nearly as long as the abdomen.

SYNONYMS. Curculio granarius. *Linn.*—Calendra granaria. *Fabricius.*—Weevil in many parts of the country.

time not a single one was to be seen, and since that period, he says, they have never appeared on his premises.

THE NUT WEEVIL*.

This insect is produced from the white grub that we often find living in the interior of the hazel nut. The history of its changes and growth is singular and interesting; and exhibits a striking instance of the care that has been taken to promote the comfort and convenience of even these diminutive tribes.

The caterpillar or grub proceeds from a very small brown egg, which the parent deposits in the outside of the nut, at a time when it is very soft and tender. When the heat of the season has perfected the little grub, it eats its way out of the egg, and through the shell, into the nut. His chief food now is the coat of the nut, or that part which afterwards hardens into the shell; and he continues to feed on this, and the interior pulp, until such time as the one becomes too hard, and the other too dry for his sustenance. He then begins on the kernel, which is now grown so large as to afford him support: and it is to be remarked, that this seems a most providential instinct; for, had he commenced his attacks on the kernel when it was small, he would have destroyed that on which all his future welfare depended, and that which is the principal food allotted to him by nature while in a larva state.

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* Description. The Nut-weevil is about a quarter of an inch in length, and of a gray-brown colour. The body is somewhat of an oval shape, having the posterior extremity not rounded off, but ending in a point. The beak, or rostrum, is red, and as long as the body.

Synonyms. Curculio nucum. *Linn.*—Phynchænus nucum. *Fabricius.*—Nut Beetle. *Harris.*

While feeding, he constantly attends to the hole by which he entered, gnawing away the sides, so as to make them very round and smooth: for this not only allows him sufficient air, and a place through which he can expel the particles of his dung, but it is also the passage through which, when he is full fed, and ready to undergo his change, he makes his way out. About the month of September, or perhaps somewhat later, the nut becomes ripe, and falls to the ground. At this time he is generally prepared for the change, and works his way through the hole, which he is some time in doing, as it is much less in circumference than his body. He then buries himself in the earth, and, shortly after, changes into a chrysalis, in which state he remains till the following spring, and about the beginning of May assumes his beetle form.

THE PARAPLECTIC WEEVIL*.

This insect has been in some measure rendered famous by the remarks of Linnæus, who believed that to it ought to be attributed the cause of the disease in horses, called the *staggers*. The larvæ of the Paraplectic Weevil inhabit the interior part of the stems of an umbelliferous plant, the *phellandrium aquaticum*, which grows in vast quantities in marshes and other watery places. Horses that have been known to have eaten of this plant, have also been known to have this disease. Linnæus asserts, that it is not the plant which causes it, but the larvæ of these insects; since it has been remarked, that such plants

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* Description. The body of this insect is cylindrical. It is black, but covered with short cinereous hairs. The wing-cases are pointed.

Synonyms. Curculio paraplecticus. *Linn.*—Le Charançon paraplectique. *Tigny.*

as were not infested with them, had been eaten by the animals without injury.

In order to find the larvæ, the stem must be slit from top to bottom. The little creatures choose for their dwelling only that portion of the stem which is submerged. They feed, with their heads always upward, on the substance or pith with which they are surrounded. Each stem contains only a single insect. The larvæ are each about seven lines in length, and somewhat more than a line in diameter. Their bodies are composed of twelve anules, which have transverse wrinkles on the back. The body is of a yellowish white colour, and the head brownish.

They undergo their transformations within the plants. On opening a stem, towards the end of July, the larva will be found to have undergone its change into a *pupa* state, without any other case to shelter it from injury, than that which the plant itself affords. In the *pupa* all the parts of the perfect insect are very distinct. Its only motion is in the abdomen; and, aided by this, it is able to pass along the cavity of the stem from one end to the other, applying for this purpose, against the parietes of the plant, the points of the abdomen, and the rows of bristles on the back.

Before the end of July they assume their perfect form; and the insects, in this state, issue into day through a large oval opening, which they form with their mandibles or jaws, in that part of the stem which is above the surface of the water. These insects do not, as Linnæus has asserted, continue during the winter within the plants.

THE DOCK WEEVIL*.

On the leaves and flowers of some of the species of Dock, or *Rumex*, the larvæ of these insects are occasionally very

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* Description. The whole body is black, covered with cine-

numerous. They are usually found from the commencement of spring, until Midsummer. They are about three lines in length, and have a black and shining head. The three first rings of the body are black above, yellow on the sides, and greenish below. There is on each ring, beneath the body, a pair of fleshy teats, which supply the place of feet in walking. The under part of the body is also supplied with a viscous matter, by which they are enabled to hold themselves firmly fixed to the stems and leaves of plants.

In order to undergo their transformation into the *pupa* state, they spin a nidus, either on the stems of the plants which they inhabit, or amongst the flowers at the summit of the stem. This nidus is spherical, about the size of a pea, and very beautiful. It is composed of a yellowish or whitish silk, woven with large meshes, (so as to render the insect which is within it perfectly visible,) and appears not unlike a sphere of the finest gauze. In spinning this, the larva holds its body curved in a somewhat semicircular shape, by which the round shape of the nidus is obtained; its own body serving as the mould. A few days after this is completed, the insect changes to a *pupa* of a black colour. In this state it continues about twelve days, and then undergoes its final transformation.

OF THE CERAMBYX OR CAPRICORN TRIBE.*

The insects of the present tribe are among the most beautiful that are produced. Their antennæ are frequent-

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reous hairs. The wing-cases are dark, varied with cinereous. The antennæ are brown at the base, and black at the extremity.

SYNONYMS. Curculio rumicis. *Linn.*—Le Charanzon de l'Oseille. *Tigny.*

* The antennæ of the Cerambyces are tapering and articulated. The thorax has several prominences; and the wing-cases are long and narrow. To the mouth there are four palpi, or feelers.

ly longer than the body. Many of the species diffuse a strong, but seldom an unpleasant smell, perceptible at a great distance; and some of them, when seized, emit a sort of cry, produced by the friction of the thorax on the upper part of the abdomen and wing-cases.

Their *larvæ* are found in the inner parts of trees, through which they bore, feeding on and pulverizing the substance of the wood. They are transformed into perfect insects in the cavities they thus make, and never issue from their retreats till they have attained their perfect state.

THE TIMBER CAPRICORN *.

Both in its perfect and in its larva state this insect feeds principally on fir timber, which has been felled some time, without having had the bark stripped off; but it is often found on other wood.

The circumstance of this destructive little animal attacking only such timber as hath not been stripped of its bark, ought to be attended to by all persons who have any concern in this article; for the bark is a temptation not only to this but to various other insects; and much of the injury done in timber might be prevented, if the trees were all barked as soon as they were felled.

The female is furnished at the posterior extremity of her body with a flat, retractile tube. This she inserts be-

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* Description. The body of this insect is of a dark violet colour, somewhat hairy and punctured. The thorax is rounded and downy; and the antennæ are nearly as long as the body. The wing-cases are narrow, rounded at the tip, and bulging towards the base. The head and thorax are sometimes greenish. The body is from four lines and a half to seven and a half in length.

Synonyms. Cerambyx violaceus. *Linn.*—Callidium violaceum. *Fabricius.*

tween the bark and the wood, to the depth of about a quarter of an inch, and there deposits a single egg.

By stripping off the bark, it is easy to trace the whole progress of the larva, from the spot where it is hatched, to that where it attains its full size. It first proceeds in a serpentine direction, filling the place which it leaves with its excrement, resembling saw-dust, and so stopping all ingress to enemies from without. When it has arrived at its utmost dimensions, it does not confine itself to one direction, but works in a kind of labyrinth, eating backwards and forwards; which gives the wood under the bark a very irregular surface: by this means its paths are rendered of considerable width. The bed of its paths exhibits, when closely examined, a curious appearance, occasioned by the erosions of its jaws, which excavate an infinity of little ramified canals. When the insect is about to assume its pupa state, it bores down obliquely into the solid wood, to the depth sometimes of three inches, and seldom, if ever, less than two. These holes are nearly semi-cylindrical, expressing exactly the form of the grub.

At first sight, one would wonder how so small, and seemingly so weak an animal, could have strength to excavate so deep a mine; but when we examine its jaws, our wonder ceases: these are large, thick, and solid sections of a cone, divided longitudinally, which, in the act of mastication, apply to each other the whole of their interior plane surface; so that they grind the insect's food like a pair of millstones.

Some of the larvæ are hatched in October; and it is supposed that about the beginning of March they assume their *pupa* state. At the place in the bark, opposite to the hole from whence they descended into the wood, the perfect insects gnaw their way out, which generally takes place betwixt the middle of May and the middle of June.

These insects are supposed to fly only in the night, but during the day they may be generally found resting on the wood from whence they were disclosed.

The larvæ are destitute of feet, pale, folded, somewhat hairy, convex above, and divided into thirteen segments. Their head is large and convex.

OF THE LAMPYRIS OR GLOW-WORM TRIBE *.

The name of this insect is derived from the luminous appearance of the posterior part of their abdomen. The males are all winged, but most of the females are destitute of wings. In some of the species the males are not luminous. The larvæ, which feed chiefly on plants and leaves, nearly resemble the females in appearance.

There are about sixty known species, inhabitants of different parts of the world; one only of which is found in Great Britain.

THE COMMON GLOW-WORM †.

During the summer season these insects are observed after sun-set, in meadows, by road sides, and near bushes.

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* The antennæ are thread-shaped. The thorax is plain, somewhat orbicular, and conceals the head. The segments of the abdomen terminate in folded papillæ.

† Description. The male Glow-worm is smaller than the female: their heads are of the same shape, and equally concealed by the plate of the thorax. The principal difference between the sexes is, that the abdomen of the male is covered with brown wing-cases, shagreened, and marked longitudinally with two lines: these are longer than the abdomen. The female is destitute of wings.

Synonyms. Lampyris noctiluca. *Linn.*—Lampyre lumineux. *Latreille.*

Among the crooked lanes, in every hedge, the Glow-worm lights his gem, and

> through the dark
> A moving radiance twinkles.

They are most frequently to be seen during the month of June. In the day time they conceal themselves amongst the leaves of plants.

Each sex is luminous, but in the male the light is less brilliant, and confined to four points, two of which are situated on each of the two last rings of the abdomen. The utility of the bright light of the females is supposed to consist in attracting the attention of the males during the dark, when, only, they are able to render themselves conspicuous. They always become much more lucid when they put themselves in motion. This would seem to indicate that their light is owing to their respiration; in which process, it is probable, phosphoric acid is produced by the combination of oxygen gas with some part of the blood, and that a light is given out through their transparent bodies by this slow internal combustion. By contracting themselves, the insects have a power of entirely withdrawing it: when they are at rest, very little light is to be seen. Mr. Templer, who made many observations on these insects, says that he never saw a Glow-worm exhibit its light at all, without some sensible motion either in its body or legs. This gentleman, when the light was most brilliant, fancied that it emitted a sensible heat.

If the insect is crushed, and the hands or face are rubbed with it, they contract a luminous appearance similar to that produced from phosphorus. When a Glow-worm is put into a phial, and the phial is immersed in water, a very beautiful irradiation will be found to take place.

The female Glow-worms lay a great number of eggs on the turf, or plants on which they live. These eggs are somewhat large for the size of the insects, of a round shape, and lemon colour. When first deposited they are

covered with a yellow, viscous matter, which serves to fix them to the plant.

When full grown the larvæ are about an inch long, and so nearly resemble the females in appearance, that it is a difficult matter to distinguish them. When these change to their *pupa* state, the skin generally splits on the middle of the head and back, and leaves an opening sufficient to give passage to the whole body.

As soon as the larva is completely disengaged from the skin, it curves its body into an arc, and is then in a *pupa* state. It still has much resemblance to the larva. The only indication of life now, is its curvature, from time to time, downwards, and its moving occasionally from side to side.

*OF THE ELATER OR SKIPPER TRIBE**.

The Elaters fly with great facility, and, when thrown upon their back, are able to recover their position without using their feet: for this purpose the thorax terminates in a strong, elastic spine, which is placed in a cavity of the abdomen. The insects, when upon their back, raise up the middle part of their body, so as to leave only the head and tail in contact with the plane on which they lie. The spine of the thorax is by this motion brought considerably out of its lodgment, and made to press against the side. Being from this position again slipped into its groove, with all the force the creatures are able to exert, the thorax and abdomen come together with so sudden a jerk, as to raise the body from the plane, and enable them to spring round.

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* The antennæ are filiform, and for the most part serrated. The under part of the thorax terminates in an elastic spine, placed in the cavity of the abdomen.

The larvæ live and undergo their changes in the trunks of decayed trees.

THE NIGHT-SHINING SKIPPER *.

In the savannas of most of the warmer parts of America, these insects are to be seen in great abundance, and also about the woods of several of the West India islands.

They are extremely luminous in the dark, the light proceeding chiefly from four parts; namely, from two glandular spots behind the eyes, and one under each wing. But they have the property of interrupting this light at pleasure, when these glandular spots become perfectly opake. When the rings of the abdomen are forced a little asunder, the same luminous appearance will be seen to issue indiscriminately from every part of their interior.

A person may with great ease read the smallest print by the light of one of these insects held between the fingers, and gradually moved along the lines, with the luminous spots above the letters: but if eight or ten of them be put into a phial, the light will be sufficiently great to admit of writing by it. Oviedo says, that the Indians travel in the night with them fixed to their feet and hands; and that they spin, weave, paint, dance, &c. by their light. He also conjectures, that "a marvellous water would come from them if distilled!"

They are seldom to be seen abroad during the day, for, except in the night, they are so inanimate, as even scarcely

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* Description. This insect is of an oblong form, and an inch or upwards in length. It is so strong, and exerts such elastic powers, as, when placed on its back, sometimes to spring to the height of four or five inches in recovering its natural position. Its colour is brown, except the head, which is small and blackish.

Synonyms. Elater noctilucus. *Linn.*—Larger Fire-fly. *Browne.* Flies shining like Glow-worms. *Purchas.*

to exhibit any signs of life. The Indians principally value them from their hunting and devouring the musquitoes in their habitations, which would become otherwise excessively troublesome. They catch them in the night, by holding up a torch on some eminence, to the light of which they soon come, when they are beaten down with the branches of trees; or sometimes one of them is held up in the fingers and moved about, which will attract to the place such as are near, when they are either knocked down or seized with the hand.

The use of their light, as in the glow-worms, seems to consist in discovering the sexes to each other.

OF THE DYTISCUS OR WATER-BEETLE TRIBE.*

The bodies of these insects are admirably formed for passing through the water with as little impediment as possible, being nearly boat-shaped, and on the surface perfectly smooth. They inhabit ponds and ditches, but occasionally fly abroad, in search of other waters. The males are distinguished from the females, by having a horny concave flap or shield on the fore-legs. The hind-legs in both sexes are peculiarly adapted for the aquatic residence of the insects, being furnished on the inner sides with a series of long and close-set filaments, so as somewhat to resemble fins. In the large species, the elytra or wing-cases of the males are smooth, and those of the females furrowed.

The larvæ are extremely voracious, feeding on other aquatic insects, on worms, and even on young fish. They continue in this state about two years and a half; and

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* The antennæ are setaceous. The sternum is cleft; and the body oval, and keel-shaped beneath. The hind legs are fringed on the inner sides, and formed for swimming

when about to change into *pupæ*, they form a convenient cell, and secrete themselves for the purpose in the banks or amongst the weeds.

THE MARGINATED WATER-BEETLE *.

Although water is the principal element in which these insects reside, they are, like the rest of their tribe, perfectly amphibious. They may occasionally be found in all fresh waters; but are most frequently seen either in such as are stagnant, or where the stream is extremely slow.

They are predatory and very voracious, devouring, in great numbers, not only other water insects, but oftentimes also those of the land. They seize their prey in their fore-legs, and with these carry it to their mouth. Although they are able to continue immersed for a great length of time, yet it is necessary for them to rise occasionally to the surface of the water, in order to breathe. They swim with great celerity; and, in flying, make a humming or droning noise, like other Beetles.

The larvæ have powerful jaws, and six long legs. At the posterior part of their body, which tapers towards the extremity, there are two small, slender processes, situated somewhat obliquely, and moveable at the base. It is by means of these that the larva suspends itself at the surface of the water, for the purpose of respiring the air of the atmosphere, which it does through two small cylindrical tubes, situated at the extremity of the tail.

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* DESCRIPTION. The body is black. The edges of the thorax, and the outer margins of the wing-cases, are yellow. The wing-cases of the females have numerous longitudinal grooves.

SYNONYMS. Dytiscus marginalis. *Linn.*—Le Dytisque bordé. *Cuvier.*

When the larvæ change their place in the water, or seek to escape the attack of their enemies, they give a prompt and vermicular motion to their body, and strike the water forcibly with their tail. They are excessively voracious, subsisting chiefly on the larvæ of dragon-flies, ephemeræ, gnats, and other insects.

Roesel states, that when the time of their transformation approaches, they quit the water, and enter the earth near the banks of the ponds or ditches which they frequent. Here they form a cavity in the form of an oval case, in which they undergo their change into *pupæ*, and afterwards into winged insects.

Thus these little creatures are aquatic animals in the larva state, become terrestrial under the form of *pupæ*, and amphibious when perfect insects.

*OF THE CARABUS OR GROUND-BEETLE TRIBE**.

These insects are very active and voracious, devouring the larvæ of the other tribes, and indeed all the smaller animals they can overcome. They conceal themselves under stones, or moss, and particularly under such as happen to be near the roots of old trees. Frequently, however, they are to be seen running about on the roads and fields. Some of the species are destitute of wings.

The larvæ are found chiefly in decayed wood, or under the ground, where they undergo their various changes.

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* The antennæ are thread-shaped. The feelers are mostly six in number, and the last joint of each is obtuse. The thorax is flat, and both this and the shells are margined.

THE BOMBARDIER, OR EXPLODING BEETLE *.

This insect conceals itself among stones, and seems to make little use of its wings. When it moves it is by a sort of jump; and, when it is touched, we are surprised with a noise resembling the discharge of a musket in miniature, during which a blue smoke may be seen to proceed from its extremity. The insect may at any time be made to play off its artillery by scratching its back with a needle. If we may believe Rolander, who first made these observations, it can give twenty discharges successively. A bladder, placed near its posterior extremity, is the arsenal that contains its store. This is its chief defence against its enemies; and the vapour or liquid that proceeds from it is of so pungent a nature, that, if it happen to be discharged into the eyes, it makes them smart as though brandy had been thrown into them. The principal enemy of the Bombardier is another insect of the same tribe, but three or four times its size. When pursued and fatigued, the Bombardier has recourse to this stratagem: he lies down in the path of his enemy, who advances with open mouth to seize him; but, on the discharge of the artillery, this suddenly draws back, and remains for a while confused, during which the Bombardier conceals himself in some neighbouring crevice; but, if not lucky enough to find one, the other returns to the attack, takes the insect by the head, and tears it off.

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* DESCRIPTION. The head, antennæ, thorax, and feet, of this insect, are of a brownish red colour. The eyes are black, and the abdomen and wing-cases blue, bordering on black; the latter are marked with broad but shallow striæ. This insect is sometimes found in England.

SYNONYMS. Carabus crepitans. *Linnæus.*—Le Bombardier, ou Carabe Petard. *Latreille.*

OF THE LYTTA TRIBE.

The antennæ of the Lyttæ are of equal thickness throughout; the feelers are four, unequal, the hind ones being clavate. The thorax is roundish: the head inflected and gibbous. The shells are soft, flexile, and as long as the abdomen.

THE BLISTERING LYTTA, OR SPANISH-FLY *.

In the south of France, in Spain, and in Italy, these insects are found in great abundance about the time of the summer solstice. They feed on the leaves of trees and shrubs, particularly on those of the privet, lilac, woodbine, elder, poplar, and ash. On the last named trees they are sometimes seen in such swarms, as, in a very little while, to deprive them entirely of their verdure. They always prefer the young trees to old ones. When collected together in great quantity, their odour becomes very disagreeable, even to a considerable distance.

In order to collect these insects, a cloth is extended round the foot of the tree, and they are shaken upon it. They are then taken up, tied in a bag, and killed with the vapours of hot vinegar. After this they are dried in the sun, and placed in boxes for use. The fresher the insects are, the more stimulating is the action of their blistering properties. It is consequently necessary to collect them as

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* DESCRIPTION. These beautiful insects are about an inch long, and of a shining blue-green colour. They sometimes fly in swarms, and have a nauseous smell, not much unlike that of mice. When dried, they are so light, that fifty of them will scarcely weigh a single drachm.

SYNONYMS. Lytta vesicatoria. *Linn. Gmel.*—Cantharide vésicatoire. *Latreille.*—Spanish-fly, or Cantharides, in England.

shortly after they have attained their perfect state as possible.

The ancient Greeks and Romans were acquainted with the qualities of these insects. They are mentioned by Cicero, Pliny, Dioscorides, and Galen.

The odorous particles exhaled by them, are extremely corrosive, and it is necessary to use great caution in taking them up. People have felt their dangerous effects, by gathering a quantity of them during the heat of the sun, with their hands bare, or by having fallen asleep under the trees where swarms of them had settled.

The females lay in a mass, or sometimes separately, their very small eggs, of a cylindrical form, and yellowish colour. These are hatched in about fifteen days.

The larvæ are soft, flat, whitish, and sparingly covered with small bristles. Their bodies are composed of twelve or thirteen segments, of which the three first have each two legs. In this state they appear to live in the earth, and, as it is believed, subsist on the roots of plants.

OF THE FORFICULA OR EARWIG TRIBE.

In this tribe the antennæ are bristle-shaped; and the feelers unequal and thread-shaped. The wing-cases are half the length of the abdomen, and have the wings folded up under them, somewhat in the manner of a fan. The tail is armed with a forceps.

The Earwigs undergo only a semi-metamorphosis, differing in external appearance very little in the three states.

THE COMMON EARWIG *.

It may not perhaps be known to the generality of observers, that the Earwig is possessed of wings which are

* SYNONYMS. Forficula auricularia. *Linn* —Twitch, or Twitch-ball, in some parts of the north of England.

both large and elegant, and that one of these, when extended, will nearly cover the whole insect. The elytra, or wing-cases, are short, and extend not along the whole body, but only over the breast. The wings are concealed beneath these, and are somewhat of an oval shape. There is great elegance in the manner in which the insect folds them beneath its elytra. They are first closed up lengthways from a centre close to the body, like a fan, and afterwards refolded across in two different places, one about the middle of the membrane, and the other at the centre, from whence the first folds proceeded. By this means the wing is reduced into a small compass, and proportioned to the size of the case under which it is to lie.

It is a circumstance extremely singular, that, unlike those of most others of the insect tribe, the eggs are hatched, and the young Earwigs fostered by the parent. At the beginning of the month of June, M. de Geer found under a stone a female Earwig, accompanied by many little insects, which evidently appeared to be her own young. They continued close to her, and often placed themselves under her belly, as chickens do under a hen. He put the whole into a box of fresh earth: they did not enter the earth, but it was pleasing to observe how they thrust themselves under the belly, and between the legs of the mother, who remained very quiet, and suffered them to continue there sometimes for an hour or two together. To feed them, this gentleman gave them a piece of a very ripe apple; in an instant the old one ran upon it, and ate with a good appetite; the young ones also seemed to eat a little, but apparently with much less relish. On the eighth of June he remarked, that the young Earwigs had changed their skins, and he found also the sloughs that they had quitted. This moulting produced only a slight change in their figure, yet it evidently brought them nearer to the perfect insect.

At another time, about the beginning of April, he found a female Earwig under some stones, placed over a heap of eggs, of which she took all the care imaginable, without ever forsaking them. He took both the female and her eggs, placed her in a box half filled with fresh earth, and dispersed the eggs up and down in it. She, however, soon removed them, one after another, carrying them between her jaws, and, at the end of a few days, he saw that she had collected them all into one place upon the surface of the earth, and remained constantly on the heap, without quitting it for a moment; so that she seemed truly to sit for the purpose of hatching her eggs. The young were produced about the thirteenth of May; in figure they were similar to those before mentioned; but at their birth they were all white, except towards the tail, where a yellow matter was observable through the skin, and the eyes and teeth, which were reddish. He kept them in the box with their mother, feeding them from time to time with bits of apple, and saw them grow every day, and change their skins more than once. The mother died, and her progeny devoured nearly the whole of her body. The little ones that died, underwent also the same fate. M. de Geer, however, conjectures that this took place only from want of other food, as he had neglected to supply them regularly with nutriment. On the twenty-third of July one only remained alive; it was full grown, and then in the *pupa* state.

The larvæ of the Earwigs differ little in their external appearance from the complete insects, except that they have neither wings nor elytra, and that the breast and thorax are not distinguishable. In this state they are very lively little animals, running about with great agility, even from the instant they leave the egg. On their metamorphosis to a perfect insect, part of their body bursts behind, and gives full play to the wings.

The Earwig, though in its nature extremely harmless, except in our gardens to our fruits and vegetables, has fallen, in a very particular manner, a victim to human cruelty and caprice, originating in the idea that it introduces itself into the ears, and from thence penetrates to the brain, and occasions death. I must be permitted to express a wish, that females, who but too commonly lay aside all ideas of tenderness at the very sight of it, would be convinced that the wax and membranes of the ears, are a sufficient defence against all its pretended attacks upon this organ.

Our gardeners have, it is true, some room for complaint. It lives among flowers, and frequently destroys them; and, when fruit has been wounded by flies, the Earwigs also generally come in for a share. In the night they may often be seen in amazing numbers upon lettuces and other esculent vegetables, committing those depredations that are often ascribed to snails or slugs. The best mode, therefore, of destroying them, seems to be, to attend the garden now and then in the night, and to seize them while they are feeding.

The bowl of a tobacco-pipe, and the claws of lobsters stuck upon sticks that support flowers, are the usual methods by which they are caught, as, in the day-time, they creep into holes and dark places. Placing hollow reeds behind the twigs of wall-trees, is also a good mode, if they be examined and cleared every morning. But at a midnight visit, more may be done in an hour, than by any of the other means in a week.

Hemipterous Insects*.

OF THE BLATTA OR COCK-ROACH TRIBE†.

Some of the species of Blatta, are destitute both of wings and elytra. Their larvæ differ but little in their general appearance, from the perfect insects. In a *pupa* state they have, between the thorax and the abdomen, two broad and flat rings, which cover much of the breast, and from which place the wings afterwards appear.

A few of these insects live in houses, and others conceal themselves in holes in the ground.

THE COMMON‡ AND THE AMERICAN COCK-ROACH§.

Both these insects live in houses, where they are oftentimes very troublesome, from the circumstance of their

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* The insects of the Linnean order *Hemiptera*, have their upper wings half crustaceous, and half membranaceous, not divided by a longitudinal suture, but incumbent on, or crossed over each other.

† The body is flat, and the thorax broad and margined, having the head concealed beneath. The elytra are very large. The legs are long. The abdomen terminates in four spines or bristles.

‡ DESCRIPTION. This insect is about an inch in length, and of an uniform reddish brown colour. The females are destitute of wings.

SYNONYMS. Blatta orientalis. *Linn.*—La Blattæ des Cuisines. *Tigny.*

§ DESCRIPTION. The body and wing-cases are ferruginous; and the thorax is whitish behind.

SYNONYMS. Blatta Americana. *Linn.*—La Blatte Kakkerlac. *Tigny.*

gnawing and devouring all the eatables, leather, clothes, woollen, and other things to which they have access. The common species is well known in this country, but more particularly in bakehouses and kitchens in London and its neighbourhood. They are extremely agile, and run very swiftly. During the day-time they conceal themselves in holes of walls and clefts of the floors, and issue forth only in the dark, for the purposes of plunder and devastation. The moment they perceive a light, they endeavour to escape into the places of their retreat. The smell of these insects is so powerful and unpleasant, that if they only run over provisions, they frequently render them very nauseous. They are furnished with wings, but their agility in other respects is so great, that they seldom use them.

The eggs of the Common Cock-Roach are large, and rounded at the extremities; and the sides are raised into somewhat of a keel-shape. The larvæ are able to run nimbly from the moment they have life.

The Kakkerlac, or *American Cock-Roach*, is very common in that country, and has sometimes also been found in Europe. In some parts of South America, particularly in Surinam, it causes great devastation in the houses, by gnawing the stuffs, cloths, and wool, and devouring and injuring the provisions.

It is asserted by Reaumur, that the American Cock-Roaches have for an enemy a large species of sphex. He says, that when one of these spheges encounters a Cock-Roach, it seizes it by the head, pierces it with its sting, and then carries it to its hole, the nidus, where, no doubt, it has deposited its egg, and where the Cock-Roach serves as nourishment for the future young one.

OF THE MANTIS TRIBE*.

The insects composing the present tribe have, in general, at a little distance, so much the appearance of leaves of trees, that, in countries where they are common, travellers have been struck with the singular phænomenon of what seemed to them animated vegetable substances. Their most prevailing colour is a fine green, but many of them become brown after they are dead, some of them are, however, decorated with a variety of lively hues. The thorax in most of them is very long and narrow, and has the appearance of a footstalk to the large and rounded abdomen. Their manners also, in addition to their structure, are very likely to impose on the senses of the uninformed: they often remain on the trees for hours without motion; then, suddenly rising, spring into the air, and, when they settle, again appear lifeless. These seem to be stratagems, in order to deceive the cautious insects on which they feed. Some travellers have, however, declared that they saw the leaves of trees become living creatures. Many of the Indians of South America, who have these insects very common among them, believe that they grow like the leaves on the trees, and that when they have arrived at maturity, they loosen themselves, and crawl or fly away.

The Africans consider the whole tribe, according to

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* In the insects of this tribe, the head appears but slighty attached to the thorax. The mouth is armed with jaws, and has its feelers filiform. The wings are four, membranaceous and convolute, the under ones plaited. The fore-legs are compressed, serrated, or toothed beneath, and armed with a single claw, and a lateral jointed process. The hind legs are smooth, and formed for walking, and not for leaping, as in the next tribe.

some writers, as sacred: but, according to others, only as animals of good omen. One of the species (Mantis fausta) has obtained the name of the *Hottentot's God*, and is supposed to be worshipped by this people. Professor Thunberg could not, however, observe any reason for this supposition: he says, it is held by them in such esteem, that they would not willingly injure it; and that they account any person or creature fortunate on whom it alights; but all this appeared to him to be done without paying it any sort of worship.

None of the species have ever been found in this country.

THE ORATOR MANTIS*.

This is a very widely dispersed species, being found both in Europe, Asia, and Africa. From the circumstance of its perpetually resting on its hind legs, and erecting the fore-paws close together, with a quick motion, as if in the action of praying, the country people, in various parts of the continent, consider it almost as sacred, and would not on any account injure it. "It is so divine a creature, (says the translator of Mouffet,) that if a child has lost its way, and enquires of the Mantis, it will point out the right path with its paw." Dr. Smith, however, informs us, in his tour on the Continent, that he received an account of this Mantis that seemed to savour little of divinity. A gentleman caught a male and female, and put them together in a glass vessel. The female, which in this, as in most other insects, is the largest, after a while devoured first the

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* Description. The thorax is smooth. The wing-cases are of a bright green colour; and on each of the wings there is a black spot.

Synonyms. Mantis oratoria. *Linn.*—Le Prie-Dieu, in some parts of France.

head and upper parts of her companion, and afterwards all the remainder of the body.

The young of this Mantis are preserved in the egg-state in a kind of oblong bag, of a thick spungy substance: this bag is imbricated on the outside, and fastened lengthwise to the branch of some plant. As the eggs ripen, they are protruded through the thick substance of the bag, and the larvæ, which are about half an inch in length, burst from them.

Roesel, wishing to observe the gradual progress of these creatures to the winged state, placed the bag containing the eggs in a large glass, which he closed, in order to prevent their escape. From the time they were first hatched, they exhibited marks of a savage disposition. He put different sorts of plants into the glass, but they refused them for the purpose of preying on one another. This determined him to supply them with insect food. He put several ants into the glass to them: but they then betrayed as much cowardice as they had before done of barbarity; for the instant the Mantes saw the ants, they attempted to escape in every direction. This was evidently an instinctive fear of a natural enemy. He next gave them some of the common house-flies, which they seized with eagerness in their fore-claws, and tore in pieces. But, notwithstanding their apparent fondness of flies, they continued to destroy each other through savage wantonness. Despairing at last, from their daily decrease, of rearing any to the winged state, he separated them into small parcels in different glasses; but here, as before, the strongest of each community destroyed the rest.

He afterwards received several pairs of Mantes in the winged state. Profiting by his former observations, he now separated them, placing a male and a female together in different glasses; but they still exhibited signs of a rooted enmity to each other, which neither age nor sex could soften. The instant they were in sight of each other, they

threw up their heads, brandished their fore-legs, and each waited an attack. They did not long remain in this posture; for the boldest, throwing open his wings with the velocity of lightning, rushed at the other, and often tore it in pieces. Roesel compares the attack of these creatures to that of two hussars; for they dexterously guard and cut with the edge of the fore-claws, as those soldiers do with sabres, and sometimes at a stroke one of them cleaves the other through, or severs its head from the thorax. After this, the conqueror always devours his vanquished antagonist.

The patience of the Mantis in waiting for his prey, is remarkable, and the posture to which superstition has attributed devotion, is no other than the means it uses to catch it. When it has fixed its eyes on an insect, it rarely loses sight of it, though it may cost some hours to take it. If it sees an insect a little beyond its reach, over its head, it slowly erects its long thorax, by means of the moveable membranes that connect it to the body; then, resting on the posterior legs, it gradually raises the anterior part also. If this brings it near enough to the insect, it throws open the last joint of its fore-paws, and snaps it between the spines that are set in rows on the second joint. If it is unsuccessful, it does not retract its paws, but holds them stretched out, and waits again till the insect is within its reach, when it springs up and seizes it. Should the insect go far from the spot, it flies or crawls after it slowly on the ground, like a cat; and, when the insect stops, erects itself as before.

These Mantes have a small black pupil or sight, which moves in all directions within the parts that we usually term the eyes, so that they can see their prey in any direction, without having occasion to disturb it by turning their head.

The males die in October, and the females do not long survive them.

THE DRY-LEAF MANTIS*.

This insect in its shape and colour is so exceedingly remarkable as to have uniformly suggested the idea of a dry or withered leaf; and the animal, when its wings are closed, bears so great a resemblance to such, that, on a cursory view, it might easily be mistaken for it.

The specimens that are brought to Europe are generally of a yellowish brown colour. The wings, when closed, form the oval body of the leaf, and the narrow thorax and head resemble the stalk. It is a native of India.

OF THE GRYLLUS OR LOCUST TRIBE.

All these insects feed chiefly on vegetable substances. The *larvæ* and *chrysalids* nearly resemble the present insects; they have six legs, are voracious and active, and reside principally in the ground.

Their heads are inflected, and armed with jaws that are furnished with filiform palpi, or feelers. The antennæ in some species are taper, in others thread-shaped. The wings are four, deflected and convolute; the lower ones plaited. The hind legs are formed for leaping; and on each of the feet are two claws.

THE MOLE CRICKET†.

The female of this species forms a cell of clammy earth, about the size of a hen's egg, closed up on every side, and

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* SYNONYMS. Mantis siccifolia. *Linn.*—La Feuille sèche. *Cuvier.*

† DESCRIPTION. This little creature is a complete representative of the mole, among the insect tribes. Its fore-feet are broad and

MAHARAJA SERFOGI'S SARAS

within as large as two hazel nuts. The eggs, amounting to nearly a hundred and fifty, are white, and about the size of caraway comfits; they are carefully covered, as well to defend them from the injuries of the weather as from the attacks of one of the species of black beetles, which often destroys them. The female places herself near the entrance of the nest, and, whenever the beetle attempts to seize its prey, the guardian insect catches it behind, and bites it asunder. Nothing can exceed the care of these animals in the preservation of their offspring. Wherever a nest is situated, fortifications, avenues, and entrenchments surround it: there are also numerous meanders which lead to it, and a ditch encompasses the whole, which few other insects are capable of passing.

About the middle of April, if the weather be fine, and just at the close of day, the Mole Crickets utter a low, dull, jarring note, not much unlike the chattering of the goat-sucker. In the beginning of May they lay their eggs. Mr. White says that a gardener, at a house where he was on a visit, happening to be mowing by the side of a canal, on the sixth of May, his scythe struck too deep, pared off a large piece of turf, and laid open to view a curious scene of domestic œconomy. There were many caverns and winding passages leading to a kind of chamber, neatly smoothed and rounded, and about the size of a moderate snuff-box. Within this secret nursery were deposited near a hundred eggs of a dirty yellow colour,

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strong, and in their formation and position bear a great resemblance to the fore-feet of that animal. They are used for precisely the same purpose of burrowing under the surface of the ground, where the insect commonly resides; and so expertly does it use them, that it can penetrate the earth with even greater expedition than the mole.

Synonyms. Gryllus Gryllo-talpa. *Linn.*—Acheta gryllo-talpa. *Fabricius.*—Fen-Cricket, Chur-worm, Eve-churr, in different parts of the kingdom. Courtillere, ou Gryllon-taupe, in France.

and enveloped in a tough skin, but too lately excluded to contain any rudiments of young, being full of a viscous substance. The eggs lay but shallow, and within the influence of the sún, just under a little heap of fresh mould, like that which is raised by ants.

At the approach of winter, the Mole Crickets remove their nest to so great a depth in the earth, as to have it always lower than the frost can penetrate. When the mild season comes on, they raise it in proportion to the advances of that favourable time, and at last elevate it so near to the surface, as to render it susceptible both of air and sun-shine; and if the frost returns, they again sink it to its proper depth. A method very similar is practised by the ants with their nests.

Mole Crickets are troublesome insects in hot-beds, where they make great havock, by hacking and gnawing the roots of plants with their fore-feet, the ends of which are armed with teeth like a saw.

The Rev. Mr. Gould kept a Mole Cricket alive during several of the summer months. He fed it on the larvæ and chrysalids of ants, which it seized with great voracity.

THE HOUSE CRICKET*.

These busy little insects reside altogether in our dwellings, and intrude themselves on our notice, whether we wish it or not. They are partial to houses newly built; for the softness of the mortar enables them to form their retreats, without much difficulty, between the joints of the masonry, and immediately to open communications with

* SYNONYMS. Gryllus domesticus. *Linn.*—Acheta domestica. *Fabricius.*

the different rooms. They are particularly attached to kitchens and bakehouses, as affording them a constant warmth.

"Tender insects, that live abroad, (says Mr. White,) either enjoy only the short period of one summer, or else doze away the cold, uncomfortable months in profound slumbers; but these, residing as it were in a torrid zone, are always alert and merry: a good Christmas fire is to them, what the heats of the dog-days are to others.—Though they are frequently heard by day, yet their natural time of motion is only in the night. As soon as it becomes dusk, the chirping increases, and they come running forth, and are to be seen often in great numbers, from the size of a flea to that of their full stature.

Around in sympathetic mirth
Its tricks the kitten tries,
The Cricket chirrups in the hearth,
The crackling faggot flies.

"As one would suppose from the burning atmosphere which they inhabit, they are a thirsty race, and show a great propensity for liquids, being found frequently drowned in pans of water, milk, broth, or the like. Whatever is moist they are fond of, and therefore often gnaw holes in wet woollen stockings and aprons that are hung to the fire. These Crickets are not only very thirsty but very voracious; for they will eat the scummings of pots, yeast, salt, and crumbs of bread; and any kitchen offal or sweepings.

"In the summer they have been observed to fly, when it became dusk, out of the windows, and over the neighbouring roofs. This feat of activity accounts for the sudden manner in which they often leave their haunts, as it does also for the method by which they come to houses

where they were not known before. It is remarkable, that many sorts of insects seem never to use their wings but when they wish to shift their quarters and settle new colonies.—When in the air they move in waves or curves, like wood-peckers, opening and shutting their wings at every stroke, and thus are always rising or sinking.—When they increase to a great degree, they become pests, flying into the candles and dashing into people's faces; but they may be blasted by gunpowder discharged into their crevices and crannies. In families, at such times, they are, like Pharaoh's plague of frogs,—"in their bed-chambers, and upon their beds, and in their ovens, and in their kneading-troughs."

"Cats catch hearth-crickets, and, playing with them as they do with mice, devour them. Crickets may be destroyed like wasps, by phials half filled with beer, or any liquid, and set in their haunts; for, being always eager to drink, they will crowd in till the bottles are full." A popular prejudice, however, frequently prevents any attempts at their destruction, many people imagining that their presence is attended with good luck, and that to kill or drive them away will surely bring some unfortunate occurrence on the family.

When these insects are running about a room in the dark, if they are surprised by a candle, they give two or three shrill notes. These seem a signal to their fellows, that they may escape to their crannies and lurking-holes, for the purpose of avoiding danger.

It is said that, in some parts of Africa, persons make a trade of these Crickets. They feed them in a kind of iron oven, and sell them to the natives, among whom the noise they make is thought pleasing. These people imagine that it assists in lulling them to sleep.

The organ that produces this noise is a membrane,

which, in contracting, by means of a muscle and tendon placed under the wings of the insect, folds down somewhat like a fan. This, as it is always dry, yields that sharp piercing sound that we so often hear from these animals. The noise may also be heard after the insect is dead, if the tendon be made to move.—We are told that Crickets will live, and even continue their accustomed noise, for some time after their heads are cut off.

THE FIELD CRICKET*.

Towards sun-set is the time when the Field Crickets begin to appear out of their subterraneous habitations. They are, however, so shy and cautious, that it is no easy matter to get a sight of them; for, feeling a person's footsteps as he advances, they stop short in the midst of their song, and retire backward nimbly into their burrows, where they lurk till all suspicion of danger is over. The Rev. Mr. White, of Selborne, who attentively studied their habits and manners, at first made an attempt to dig them out with a spade, but without any great success; for either the bottom of the hole was inaccessible, from its terminating under a large stone, or else in breaking up the ground the poor creature was inadvertently squeezed to death. Out of one thus bruised, a great number of eggs were taken, which were long and narrow, of a yellow colour, and covered with a very tough skin. More gentle means were then used, and these proved successful. A pliant stalk of grass, gently insinuated into the caverns, will probe their windings to the bottom, and bring out the inhabitant; and thus the humane enquirer may gratify his curiosity without injuring the object of it.

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* SYNONYMS. Gryllus campestris. *Linn.*—Acheta campestris. *Fabricius.*

It is remarkable that, though these insects are furnished with long legs behind, and brawny thighs adapted for leaping, yet, when driven from their holes, they show no activity, but crawl along in so lifeless a manner as easily to be caught. And though they are provided with a curious apparatus of wings, yet they never exert them, even when there seems to be the greatest occasion. The males only make their shrill noise, perhaps out of rivalry and emulation; as is the case with many animals, which exert some sprightly note during their breeding-time.

When the males meet, they sometimes fight very fiercely, as Mr. White found by some that he put into the crevices of a dry stone wall, where he wished to have them settle. For though they seemed distressed by being taken out of their knowledge, yet the first that got possession of the chinks seized on all that were obtruded upon them, with a vast row of serrated fangs. With their strong jaws, toothed like the shears of a lobster's claws, they perforate and round their curious regular cells, having no fore-claws to dig with, like the mole cricket. When taken into the hand, they never attempt to defend themselves, though armed with such formidable weapons. Of such herbs as grow about the mouths of their burrows, they eat indiscriminately; and never in the day-time seem to stir more than two or three inches from their home. Sitting in the entrance of their caverns, they chirp all night as well as day, from the middle of the month of May to the middle of July. In hot weather, when they are most vigorous, they make the hills echo; and, in the more still hours of darkness, may be heard to a very considerable distance.

"Not many summers ago (says Mr. White) I endeavoured to transplant a colony of these insects to the terrace in my garden, by boring deep holes in the sloping turf. The new inhabitants staid some time, and fed and sang;

but they wandered away by degrees, and were heard at a greater distance every morning: so it appears that on this emergency they made use of their wings, in attempting to return to the spot from which they were taken.

"One of these Crickets, when confined in a paper cage, set in the sun, and supplied with plants moistened with water, will feed and thrive; and become so merry and loud as to render it irksome to be in the same room with it. If the plants are not wetted it will die."

THE MIGRATORY LOCUST *.

Syria, Egypt, Persia, and almost all the south of Asia, are subject to a calamity as dreadful as volcanoes and earthquakes are to other countries, in being ravaged by those clouds of Locusts, so often mentioned by travellers. The quantity of these insects is incredible to all who have not themselves witnessed their astonishing numbers; the whole earth is covered with them for the space of several leagues. The noise they make in browsing on the trees and herbage may be heard at a great distance, and resembles that of an army foraging in secret. The Tartars themselves are a less destructive enemy than these animals. One would imagine, wherever they have been seen, that fire had followed their progress. Wherever their myriads spread, the verdure of the country disappears, as if a curtain had been removed: trees and plants are stripped of their leaves, and reduced to their naked boughs and stems; so that the dreary image of winter succeeds, almost in an instant, to the rich scenery of the spring.—When these clouds of Locusts take their flight, to surmount any obstacle, or to traverse more rapidly a desert soil, the

* Synonyms. Gryllus migratorious. *Linn.*—Locust, *var.*

heavens may literally be said to be obscured by them. Happily this calamity is not frequently repeated: for it is the inevitable forerunner of famine, and all the maladies it occasions. The inhabitants of Syria have remarked that Locusts are always increased by too mild winters, and that they constantly come from the desert of Arabia. From this observation it is easy to conceive, that, the cold not having been rigorous enough to destroy their eggs, they multiply suddenly; and, the herbage failing them in the immense plains of the desert, innumerable legions issue forth. When they make their first appearance on the frontiers of the cultivated country, the inhabitants attempt to drive them off, by raising large clouds of smoke: but frequently their herbs and wet straw fail them. They then dig trenches, where numbers of the insects are buried: but the most efficacious destroyers are the south and south-easterly winds, and the locust-eating thrushes*. These birds follow them in numerous flocks like starlings, and not only greedily devour them, but kill as many as they can: accordingly they are much respected by the peasants, and nobody is ever allowed to shoot them. As to the southerly and south-easterly winds, they drive with violence these clouds of Locusts over the Mediterranean, where such quantities of them are sometimes drowned, that, when their carcasses are thrown on the shore, they infect the air for several days, even to a great distance.

The annals of most hot countries, are filled with accounts of the devastations produced by the Locusts. They seldom now visit Europe in such swarms as formerly; yet in the warmer parts they are still formidable. Those that have at uncertain intervals visited Europe, within the memory of man, are supposed to have come from Africa,

* *Turdus gryllovorus*, of Linnæus.

—Some of them have at different times been seen in Britain, and great mischiefs have been apprehended: but, happily for us, the coldness of our climate, and the humidity of our soil, are unfavourable to their production: they therefore all perish, without leaving a young generation to succeed them.

Locusts, when they take to flight, seem at a distance like a dark cloud, which, as it approaches, almost excludes the light of day. It often happens that the husbandman sees them pass over without doing him any injury; but in this case they only proceed to settle on some less fortunate country. Wherever they alight, they make dreadful havock among the vegetation. In the tropical climates their presence is not attended with such destructive consequenees as in the southern parts of Europe; for in those the vegetative power is so strong and active, that an interval of only a few days will sometimes repair all the damage: but in Europe their ravages cannot be obliterated until the succeeding year*. In their long flights to this part of the world, from the extent of their journey, they are also nearly famished, and therefore, more voracious wherever they happen to alight.

We are told, that nearly as much damage is occasioned by what they touch, as by what they devour. Their bite is thought to contaminate the plants, and either to destroy

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* "One thing which always surprised me," says Mr. Adanson in his Voyage to Senegal, "is the amazing rapidity with which the sap of trees in this country repairs any loss they happen to sustain; and I was never more astonished than when, four days after a terrible invasion by the Locusts, in which every green thing was devoured, I saw the trees covered with new leaves, and not appear to have suffered very greatly. The herbaceous plants bore marks of the devastation somewhat longer; but a few days were sufficient to repair every mischief."

or greatly to weaken their vegetation. To use the expression of the husbandmen, "They burn wherever they touch, and in some countries leave the marks of their devastation for three or four years afterwards." When dead, they infect the air in such a manner, that the stench is frequently insupportable. Orosius tells us, that in the year of the world 3800, Africa was infested with a multitude of Locusts. After having eaten up every thing that was green, they flew off, and were drowned in the sea; where they caused such a stench, as could not have been equalled by the putrefying carcases of a hundred thousand men.

In the year 1650, a cloud of Locusts were seen to enter Russia in three different places: and from thence they spread themselves over Poland and Lithuania, in such astonishing multitudes, that the air was darkened, and the earth covered with their numbers. In some places they were seen lying dead, heaped upon each other to the height of four feet; in others they covered the surface of the ground like a black cloth: the trees bent with their weight: and the damage that the country sustained exceeded computation.

In Barbary their numbers are often formidable; and Dr. Shaw was a witness of their devastations there in 1724. Their first appearance was in the latter end of March, when the wind had been southerly for some time. In the beginning of April their numbers were so increased, that in the heat of the day, large swarms appeared like clouds, and darkened the sun. In the middle of May they began to disappear, retiring into the plains to deposit their eggs. In June the young brood came forth, forming many compact bodies of several hundred yards square; which, afterwards marching forward, climbed the trees, walls, and houses, devouring every vegetable that was in their way. The inhabitants, in order to stop their progress, formed trenches all over their fields and gardens,

which they filled with water. Some placed large quantities of heath, stubble, and other combustible matter, in rows, and set them on fire at the approach of the Locusts. This, however, was all to no purpose; for the trenches were quickly filled up, and the fires put out, by the immense swarms that succeeded each other.

A day or two after one of these was in motion, others that were just hatched came to glean after them, gnawing off the young branches, and the very bark of the trees. Having lived near a month in this manner, they arrived at their full growth, and threw off their larva state by casting their skins. To prepare themselves for this change, they fixed their hinder parts to some bush or twig, or corner of a stone; when, immediately, by an undulating motion, their heads would first appear, and soon after the rest of their bodies. The whole transformation was performed in seven or eight minutes' time; after which they remained for a little while in a weak state; but as soon as the sun and air had hardened their wings, and dried up the moisture that remained after casting their sloughs, they returned to their former greediness, with an addition both of strength and agility. But they did not long continue in this state before they were entirely dispersed. After laying their eggs, they directed their course northward, and probably perished in the sea.

Of the innumerable multitudes that infested the interior parts of Southern Africa, in the year 1797, scarcely any adequate conception can be formed. Mr. Barrow says, that in the part of the country where he then was, for an area of nearly 2000 square miles, the whole surface of the ground might literally be said to be covered with them. The water of a very wide river was scarcely visible, on account of the dead carcasses that floated on the surface, drowned in the attempt to come at the reeds that grew in it. They had devoured every blade of grass, and every

green herb, except the reeds.—They are not, however, without a choice in their food. When they attack a field of corn just come into ear, this gentleman says they first mount to the summit, and pick out every grain before they touch the leaves and stem. The insect seems to be constantly in motion, and always to have some object in view. When the larvæ (for these are much more voracious than the perfect insects) are on a march during the day, it is utterly impossible to turn the direction of the troop, which is generally with the wind. Towards the setting of the sun the march is discontinued, when the troop divides into companies that surround the small shrubs or tufts of grass, or ant-hills, and in such thick patches, that they appear like so many swarms of bees; and in this manner they rest till day-light. At these times it is that the farmers have any chance of destroying them, which they are sometimes able in a great measure to effect, by driving among them a flock of two or three thousand sheep: by the restlessness of these, great quantities of them are trampled to death.

The year 1797 was the third of their continuance in Sneuwberg; and their increase, according to Mr. Barrow's account, had far exceeded that of a geometrical progression, whose ratio is a million.

For ten years preceding their present visit, this district was entirely free from them. Their former exit was somewhat singular. All the full-grown insects were driven into the sea by a tempestuous north-west wind, and were afterwards cast upon the beach, where, it is said, they formed a bank three or four feet high, that extended a distance of nearly fifty English miles; and it is asserted, that when this mass became putrid, and the wind was at south-east, the stench was sensibly felt in several parts of Sneuwberg, distant at least a hundred and fifty miles.

The female Locust, when she lays her eggs, which are

generally about forty in number, retires to some solitary place underground; where, by her sagacity, she secures them from the intemperance of the air, as well as from the more immediate danger of the plough or spade, one fatal blow of which would destroy all the hopes of a rising generation.

One would imagine, that so horrid an insect as the Locust, would never have been thought of as food for man; and yet it is an undoubted fact, that in several parts of Africa, the people eat them. They are dressed in different ways: some pound and boil them with milk: others only broil them on the coals, and think them excellent food. "There is no disputing about tastes, (says Mr. Adanson,) for my part, I would willingly resign whole clouds of Locusts to the negroes of Gambia, for the meanest of their fishes."

OF THE LANTERN FLIES IN GENERAL.

In this tribe, the head is extended forward, and is hollow and inflated. The antennæ, consisting of two joints, the outer one of which is globular, are seated below the eyes. The rostrum or beak * is four-jointed, and inflected or bent inwards under the body. The legs are not formed for leaping.

THE GREAT LANTERN FLY †.

This is the most vivid of all the luminous insects. It affords a light so great, that travellers, walking by night,

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* This is a jointed sheath, situated in the mouth, and containing setæ or bristles, used in extracting the juices from plants, and for some other purposes.

† Description. The head in this species is large, and some-

are said to be enabled to pursue their journey with sufficient certainty, if they tie one or two of them to a stick, and carry this before them in the manner of a torch: It is common in many parts of South America, and is described by Madam Merian, in her superb work on the insects of Surinam. She gives an entertaining account of the alarm into which she was thrown, by the flashing which proceeded from them in the dark, before she had been apprised of their shining nature.

"The Indians once brought me (says she) before I knew that they shone by night, a number of these Lantern-flies, which I shut up in a large wooden box. In the night they made such a noise, that I awoke in a fright, and ordered a light to be brougnt, not being able to guess from whence the noise proceeded. As soon as I found that it came from the box, I opened it, but was still more alarmed, and let it fall to the ground in my fright, at seeing a flame of fire come out of it; and as many animals as came out, so many different flames appeared.—When I found this to be the case, I recovered from my alarm, and again collected the insects, much admiring their splendid appearance." The light, she adds, of one of these insects is so bright, that a person may see to read a newspaper by it.

The light emitted by this fly, proceeds entirely from the hollow part, or lantern, of the head; no other part of the animal being luminous. Dr. Darwin conjectures, that the use of this light is merely to prevent the insects from flying against objects in the night, and to enable them to

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what oval. The wings are variegated; and the lower pair is marked each with a large ocellated or eye-like spot. Sometimes the insect is seen of three or four inches in length.

Synonyms. Fulgora lanternaria. *Linn.*—La Fulgore porte-lanterne, by the French.

procure their sustenance in the dark. He seems, however, not to have considered that very few of the numerous train of night-insects possess this luminous property, and yet all the functions of these are performed with perfect regularity. Its most essential use is, no doubt, as in the other luminous tribes, to point out the sexes to each other, serving in them the same purpose, in this respect, as the voice in larger animals.

*OF THE CICADÆ IN GENERAL**.

These insects are found in various parts both of the new and old Continent, where they subsist almost wholly on the leaves of trees and other vegetable substances. They are furnished with a hard and horny proboscis or tube, in which is contained a very slender sucking pipe. The former is not much unlike a gimlet in form, and is used by them in boring through the bark of trees, for the purpose of extracting their juices. With this proboscis they also bore holes in the small and tender twigs of the exterior branches, in which they deposit their eggs, sometimes to the amount of six or seven hundred. Each cell does not contain more than from twelve to twenty, so that by this means they often do much damage to the trees which they frequent.

The *chrysalids* of these insects are not torpid, as in many others, but have six legs, and differ from the parent, in having only the rudiments of wings. They are exceedingly active, and in general run and leap about upon the trees with great sprightliness.

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* The Cicadæ have an inflected rostrum, and bristle-shaped antennæ. The wing-cases are membranaceous, and decline along the sides of the body. Their legs are in general formed for leaping.

The males of the perfect insects make a chirping noise, of use in alluring the females. Some naturalists suppose that this noise is caused by the flapping of the lamellæ against the abdomen; others, by the rustling of the segments of the body in the contractile motion of that part: and Beckmann, that it is caused by the beating of the body and legs against the wings. The lamellæ, on examination, do not appear to have sufficient freedom of motion to produce such a sound.

Those of the hottest climates make the loudest noise. From the papers of Mr. Smeathman, who resided a considerable time in Africa, it appears that some are so loud, as to be heard to the distance of half a mile; aad that the singing of one of them in a room, will immediately silence a whole company. Professor Thunberg says, that one of the Javanese species makes a noise as shrill and piercing, as if it proceeded from a trumpet.

Several of the species were known to the ancients, who considered them as the emblems of eternal youth. They deemed them creatures beloved both by Gods and men; and indulged many poetical fictions concerning them, but particularly that they subsisted only on dew. The Athenians wore golden Cicadæ in their hair, to denote their national antiquity, or that, like these creatures, they were the first-born of the earth. Anacreon, addressing one of them, depicts, in glowing colours, the felicity which they were universally supposed to enjoy.

> Happy creature! What below
> Can more happy live than thou?
> Seated on thy leafy throne,
> (Summer weaves the verdant crown,)
> Sipping o'er the pearly lawn
> The fragrant nectar of the dawn;
> Little tales thou lov'st to sing,
> Tales of mirth—an insect king.

Thine the treasures of the field,
All thy own the seasons yield;
Nature paints thee for the year,
Songster to the shepherds dear:
Innocent of placid fame,
What of man can boast the same?
Thine the lavish'd voice of praise,
Harbinger of fruitful days;
Darling of the tuneful nine,
Phœbus is thy sire divine;
Phœbus to thy notes has giv'n
Music from the spheres of heav'n;
Happy most, as first of earth,
All thy hours are peace and mirth;
Cares nor pains to thee belong,
Thou alone art ever young;
Thine the pure immortal vein,
Blood nor flesh thy life sustain;
Rich in spirits, health thy feast,
Thou'rt a demi-god at least.

THE WAX-FORMING CICADA*.

This is a singular insect, and deserving of some attention, both as an object of curiosity, and from its importance in domestic œconomy.

The larvæ are elegant and beautiful creatures, and to their labours the Chinese are indebted for the fine white wax that is so much esteemed in the East-Indies. They form a sort of white grease, which adheres to the branches of trees, hardens there, and becomes wax. It is scraped

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* Description. The wing-cases of the Wax-forming Cicada are green, margined with red, and deflexed; and the interior ones are spotted with black. In the variety figured and described by Sir George Staunton, these are whitish, margined with black, and have a row of black spots on the posterior edge.

Synonyms. Tettigonia limbata. *Fabricius.*—Cicada limbata.

off in the autumn, melted on the fire, and strained; it is then poured into cold water, where it coagulates, and forms into cakes. In appearance, it is white and glossy, and, mixed with oil, is used to make candles, for which purpose it is thought greatly superior to bees-wax.

The insects are white when young, and it is then that they make their wax. When old, they are of a blackish chesnut colour, and form little pelotons on the branches of trees. These at first are each of the size of a grain of millet; towards the beginning of the spring they increase in bulk and spread; they are attached to the branches like grapes, and, at first sight, the trees that bear them, appear loaded with fruit. About the beginning of May the inhabitants gather them, and, having enveloped them in the leaves of a species of broad-leaved grass, suspend them to the trees. At the end of June, and in July, the pelotons open, and the insects come forth, crawl about the leaves, and form their wax.

Sir George Staunton says of these insects, that he saw them busily employed upon the small branches of a shrub, that, in its general habit, had a considerable resemblance to privet. They did not much exceed the size of the domestic fly, and were of a very singular structure. They were in every part covered with a kind of white powder: and the branches they most frequented, were entirely whitened by this substance strewed upon them.

THE AMERICAN LOCUST *.

This species of Cicada is at all times very common in Pennsylvania, but at certain periods (generally of fourteen

* Description. The body of this insect is black; and the upper wings are white, with a yellowish rib.

Synonyms. Cicada septendecim. *Linn.*—Tettigonia septendecim. *Fabricius*.

or fifteen years) the numbers are so immense, that it has obtained the general appellation of Locust.

Towards the end of April these insects emerge from the ground; and their appearance is always to be predicted by the swine searching for them. The swarms are sometimes so great, that in the places from whence they have arisen, the earth appears nearly as full of holes as a honey-comb. They always leave the ground during the night. On their first coming out they are in the chrysalid state; but soon afterwards the back bursts, and the flying insects disengage themselves from their case. For a little while they are entirely white, with red eyes, and seem very weak and tender; but, by the next day, they attain their full strength and perfection, being of a dark brown colour, with four finely varied transparent wings.

They are very active, flying about from tree to tree with great agility. The female is directed to the male by the loud chirping noise which he makes. She lays her eggs about the latter end of May, piercing for this purpose the tender twigs of trees with the dart from her tail. With this she is able to penetrate the wood in a surprisingly expeditious manner, crowding it for the length of two or three inches full of eggs, ranged in close lines, containing from twelve to eighteen in each. She always darts to the pith of the branch, in order that the larvæ, when they proceed from the eggs, may find food proper for their tender state. When these are full grown they drop off, and make their way into the ground, in order to prepare for a change. Here they are sometimes found at the depth of two feet or upwards.

For the sake of experiment, some of the eggs of this species, about the usual time of hatching, were taken out and spread upon a table. In about an hour they cracked; and it was very entertaining to observe how the little insects contrived to disengage themselves from the shell. When they had got clear from all incumbrances, they ran about

very briskly, evidently searching for a repository in the earth.

Very shortly after attaining their perfect state, these insects always spread over the country for many miles round. They are excessively voracious, and do infinite damage, in their periodical swarmings, to both orchard and forest trees; and were it not for the number and variety of their enemies, and the naturally short duration of their lives, the inhabitants would often suffer from them all the horrors of famine. It seems to have been of these insects that Mr. Hughes says, such vast swarms were bred, or came into the island of Barbadoes, in the year 1734-5, that they destroyed almost every green and tender plant. So great was the destruction they caused, especially among the potatoe vines, on whose roots the poor people chiefly subsisted, and such the scarcity of food occasioned by them, particularly in the parish of St. Philip, that a collection was made for these sufferers through the rest of the island.

Domestic fowls are fond of them; and even some of the American squirrels become fat with them, at the times when they are very abundant. The Indians also pluck off their wings, and boil the bodies for food.—It is said that they may be kept from the trees, by suspending on the branches pieces of tow, impregnated with a mixture of brimstone and train-oil.

THE BLACK-HEADED FROGHOPPER *.

The larvæ or grubs of this insect are well known as discharging from their bodies, upon the branches and

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* DESCRIPTION. This insect is of a brownish colour, and has on the upper wings two lateral whitish spots.

SYNONYMS. Cicada spumaria. *Linn.*—Cereropis spumaria. *Fabricius.*—Cuckoo spit or Froth-worm.

leaves of plants, a kind of frothy matter, called by the country-people in many parts of England, *Cuckoo-spit.* In the midst of this they constantly reside, probably for shelter against the rapacity of such stronger insects, as would otherwise prey upon them. Nature seems to have afforded this kind of defence to the insects, as their naked and soft bodies might otherwise very easily be injured; perhaps, also, the moisture of this foam may serve to screen them from the sultry beams of the sun. On removing the foam, the grub is discovered underneath; but it will not remain long uncovered. It soon emits fresh foam, that again hides it from observation.

In the midst of its foam it is, that the larva goes through its metamorphosis to a chrysalis and a winged insect. This may be observed by any person who is careful enough to watch when the froth begins a little to subside. At this period he must put the insect with its leaf under a glass. The froth, degenerating to a white film, fixes the creature to the leaf: soon afterwards the fly may be seen first putting out its head, and then by degrees its body. As soon as the fore-part is out, a small protuberance will be perceived on each side, which, every moment growing larger, will soon appear to be the wings of the fly unfolding by degrees. In about a quarter of an hour the whole change is completed, the fly is liberated, its wings are extended over its body, and the fine silver-like case of the larva, with all its legs and other apparatus, will be seen left behind.

This insect is very common in meadows and pastures, and is so agile, that when attempted to be caught, it will sometimes spring to the distance of twelve or eighteen inches.

OF THE CIMECES OR BUGS IN GENERAL.

The rostrum of the Cimices or Bugs is inflected; and the antennæ are longer than the thorax. They have four wings folded cross-wise, the upper ones coriaceous on the upper part. The back is flat, and the legs are formed for running.

The *larvæ* differ from the perfect insects in little else than the want of wings. Many of them infest plants, on which they live, and in which they lay their eggs. Several of the species are voracious, and spare scarcely any other insects that they can conquer. They glut themselves with the blood of animals; destroy caterpillars, flies, and even beetles, the hardness of whose elytra would seem to be proof against all their attacks; the incautious naturalist may also himself sometimes experience the severity of their nature.

THE BED BUG*.

The Bed Bug, which is a nauseous and troublesome inhabitant of most of the houses in large towns, is singular in having neither wings nor wing-cases. It runs about with considerable activity in the night, to suck the blood of persons that are asleep, hiding itself by day in crevices and other retired places.

It is supposed to have been first introduced to this country, in the fir timber that was brought over for the purpose of rebuilding London, after it had suffered by the great fire; for it is generally said that Bugs were not known in England before that time; and many of them

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* Synonyms. Cimex lectularius. *Linn.*—Acanthia lectularia. *Fabricius.*

were found almost immediately afterwards in the new-built houses.

Their most favourite food is blood, dried paste, size, deal, beech, osier, and some other kinds of timber, the sap of which they suck; and on any of these they are able to exist. They will not feed on oak, walnut, cedar, or mahogany; for several pairs, which, for the sake of experiment, were confined with these kinds of wood, soon died, whilst those kept with the others continued to thrive through the whole year.

The female generally lays about fifty eggs at a time, which are white, and, when protruded, are covered with a viscous matter, which, afterwards hardening, sticks them firmly to the place where they are deposited. These are usually hatched in about three weeks. The general times of laying are March, May, July, and September: so that from every female Bug that outlives the season, as many as two hundred young ones may be produced. Thus is the excessive increase of these nauseous animals to be accounted for, where proper care is not taken to destroy them.

The young, for some time after they first escape from the egg, are perfectly white, but they generally become brown in the course of about three weeks. In eleven weeks they are at full growth. They are then very watchful and cunning creatures; and so fierce, among their own species, that they will sometimes contend with the utmost fury; and in their combats they seldom leave off till either one or both of the animals are killed. Spiders are very fond of them, and often seize them for food.

In order to clear a house of Bugs, the leading point is cleanliness in every respect, for this is their greatest annoyance; and by this alone their increase is to be materially checked. The first young begin to burst from the eggs early in spring, frequently even in February. At this

season it is that the greatest attention is required. The bed infested by them, ought to be stripped of all its furniture, which should be washed, and, if linen, even boiled, or if stuff, hotpressed. The bedstead should be taken in pieces, and dusted, and washed with spirits of wine in all the joints and crevices, for it is in these parts principally, that the females deposit their eggs. This done, all the cavities should be well filled with the best soft soap, mixed up with verdigrease and Scotch snuff. On this composition the young will immediately feed, after leaving the egg, (if any escape the cleansing,) and will be destroyed, as will also such of the old ones as happen to be left.

Bugs abound in all the hot climates, from whence most of our merchant-vessels are over-run with them. This accounts for their extreme numbers in all the seaport towns of this country, and particularly in the metropolis, being conveyed thither in clothes, packages, &c. Hence appears the great necessity of examining carefully every thing brought from such vessels into the houses.

Deal and beech boards should by all means be removed, as should also every thing that is fixed to a bed by means of paste, as these afford them both shelter and food. Oak and mahogany are probably the best kinds of wood to use, as the closeness of their texture allows the animals but an uncomfortable situation.

It is supposed that Bugs do not altogether lie torpid during the winter, but that in the cold weather they require less nutriment, and therefore that they are not tempted to come so often out of their retreats, as they do in the warmer seasons of the year.

THE PARADOXICAL BUG*.

"That singular insect, the Cimex Paradoxus, which (says Dr. Sparrman) I have described, and of which I have given a drawing in the Swedish Transactions, I discovered at this place, (the Cape of Good Hope,) as at noon-tide I sought for shelter among the branches of a shrub, from the intolerable heat of the sun. Though the air was now extremely still and calm, so as scarcely to have shaken an aspen leaf, yet I thought I saw a little withered, pale, crumpled leaf, eaten as it were by caterpillars, flitting from the tree. This appeared to me so very extraordinary, that I thought it worth while suddenly to quit my verdant bower in order to contemplate it; and I could scarcely believe my eyes, when I saw a living insect, in shape and colour resembling the fragment of a withered leaf, with the edges turned up and eaten away, as it were, by caterpillars, and at the same time all over beset with prickles. Nature, by this peculiar form, has certainly extremely well defended, and concealed as it were in a mask, this insect from birds and its other diminutive foes; in all probability with a view to its preservation, and to employ it for some important office in the system of her œconomy; a system with which we are too little acquainted, in general too little investigate, and, in every part of it, can never sufficiently admire with that respect and adoration, which we owe to the great author of nature, and ruler of the universe."

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* SYNONYMS. Cimex paradoxus. *Linn. Gmel.*—Acanthia paradoxa. *Fabricius.*

OF THE APHIDES OR PLANT LICE.*

The minnte animals which compose this singular tribe live entirely on vegetables, and the loftiest tree is as liable to their attacks as the most humble plant. Their numbers are often incalculably great. They prefer the young shoots on account of their tenderness, and frequently insinuate themselves into the very hearts of the plants, doing irreparable mischief even before they are discovered. But for the most part they beset the foliage, and are always found on the under side of the leaf. This they prefer, not only on account of its being the most tender, but because it affords them protection from the weather, and from various injuries to which they would be otherwise exposed. Sometimes, though rarely, the root is the object of their choice; and the roots of lettuces have been observed so thickly beset with one of the species, that the whole crop has been rendered sickly and of little value. They are rarely, except one species (*aphis salicis*, which is larger and much stronger than the others,) to be found on the bark of trees.

Some of the species are constantly and unalterably attached to one or more particular kinds of plants; but others feed indiscriminately on most sorts of herbage.

These insects are sometimes winged, and sometimes destitute of wings, without any distinction of sex. In the spring they are viviparous, producing their offspring alive; and in the autumn they are oviparous, depositing their

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* The beak of the Aphides, the sheath of which is composed of five joints, is inflected. The antennæ are tapering, and longer than the thorax. These insects have either four wings, or are entirely destitute of them. At the abdomen there are two obtuse erect horns; and the tail is sometimes terminated by a small style.

eggs, like most other insects, in places where they remain secured through the winter till the ensuing spring, when they are hatched. The Aphides afford also another surprising deviation from the general laws of nature; one impregnation of the female is sufficient for nine generations.

The *larvæ*, *chrysalids*, and perfect insects, have so little difference in external appearance, that they cannot be distinguished from each other.

THE APHIS OF THE ROSE TREE*.

Towards the beginning of February, if the weather be sufficiently warm to make the buds of the rose-tree swell and appear green, this species of Aphis will be found on them in considerable abundance. They are produced from small, black, oval eggs, which were deposited in autumn on the last year's shoots. If, after their appearance, the season become cold, almost the whole of them suffer, and the trees are, for that year, in a great measure freed from them.

Those that withstand the severity of the weather seldom arrive at their full growth before April, when, after twice casting their skins, they usually begin to breed. It then appears that they are *all females*, and each of them produces a numerous progeny, and that without any intercourse with a male insect.—These, though themselves produced from eggs, are viviparous. Their young, when they

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* Description. This insect, which is well known by the name of *Rose Louse*, is generally of a green colour; with the tip of the antennæ and horns black. The tail is pointed, and without a style.

Synonyms. Aphis Rosæ. *Linn. Gmel.*—Rose Louse, or Rose Aphis.

first come from the parent insects, are each enveloped in a thin membrane that has the appearance of an oval egg. This apparent egg adheres by one extremity to the mother, while the young Aphis proceeding from it, extends the other, by this means gradually drawing the ruptured membrane over the head and body to the hind feet. During the operation, and for some time afterwards, the fore part of the head adheres, by the viscous matter about it, to the tail of the parent. Thus suspended, it soon entirely frees itself from its former envelopment; and when its limbs become a little strengthened, it is set down on some tender shoot, and there left to provide for itself.

In the spring months there appear but these two generations of the Aphis: the warmth of summer, however, produces no less than five. One of these comes forth in May, and the months of June and July supply each two more. The insects of the May breed cast their skins twice, and the others three or four times, according to the warmth of the season. When the heat has been sufficiently great, and the food in tolerable plenty, the first change has been observed to take place in about ten days after their production.

Early in June some of the third generation, which were produced about the middle of May, after casting their last covering, discover four erect wings much longer than their bodies. The formation of the wings seems to depend not on sexual distinction, nor even on the original structure of the insects, so much as on the quantity and quality of the nourishment with which they are supplied. Few of those on succulent shoots have wings, while those of the same generation on the less tender branches are most of them winged. Some time before they come to their full growth, it is easy to discern which of them will have wings, from a remarkable fullness of the breast. When the last covering is rejected, the wings, which were before folded in a

very narrow compass, gradually extend in a most beautiful manner to their proper size and dimensions. All the subsequent breeds are winged.

In the autumn, the eighth, ninth, and tenth generations are produced; two in August, and the last about the middle of September. The two first resemble the summer breeds, but the third differs very greatly from all the rest. Though all the Aphides which have hitherto appeared have been females, in this tenth generation several *male* insects are found. The females have at first the appearance of the summer insects; but in a few days their colour changes from green to yellow, and gradually, before their full growth, to orange. These yellow females are destitute of wings. The males, when they first appear, are of a reddish brown, but have afterwards, when they begin to thicken about the breast, a dark line along the middle of the back. They come to their full growth in about three weeks, and then, casting their last skin, appear in every part, except the wings, of a bright yellow. They shortly afterwards, however, become dark brown. The wings become transparent, and at length are in appearance not unlike very fine black gauze. The females soon begin to deposit their eggs, which, if possible, is always done near the buds of the branches, that the future young may be the more easily supplied with nourishment. Some of them continue to lay their eggs until the beginning of November: these eggs are oval, and, when first protruded, are green, but they soon become perfectly black. They adhere to the branches on which they are deposited by the viscous matter that at first surrounds them. These eggs remain through the winter, till the ensuing spring, before they are hatched.

If the Aphides had not many enemies, their increase in summer would be so great as, by wounding and exhausting the tender shoots of the trees, sometimes to suppress

their vegetation. Among their enemies, one of the principal is a small black species of Ichneumon fly*, which darts its pointed tail into the bodies of the Aphides, and at the same time deposits in each an egg. This egg afterwards produces a grub, which feeds on the body of the insect till it has acquired its full growth, when it undergoes its change, and entirely destroys its living nidus.

After a mild spring, most of the species of Aphis become so numerous as to do considerable injury to the trees on which they are found. The best mode of remedying this evil is to lop off the infected shoots before the insects are greatly multiplied, repeating the same operation before the time that the eggs are deposited. By the first pruning, a very numerous present increase will be prevented; and by the second, the followiug year's supply may, in a great measure, be cut off.

THE APHIS OF THE BEAN †.

Among the Garden Beans a small black Aphis may frequently be observed, adhering to the tops in immense numbers, and afterwards gradually spreading over the whole plants. They are principally to be observed in the months of June and July; and so small and light are they as oftentimes to be carried from one plant to another by the wind. They seldom appear until after the beans are in blossom; and if carefully watched, it will be found that they are confined to a small extent. Dr. Anderson says that he has seen a row of beans greatly tainted, whilst another, at the distance only of six or eight feet, had none. At the beginning, the upper leaves and the blossom are alone infected. These now appear crumpled together, and

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* The *Ichneumon aphidum* of Linnæus.

† SYNONYM. Aphis fabæ. *Linn.*

full of blackish specks. Whenever this is perceived, the tops should all be cut off. By this means the danger of their increase, especially in gardens, may be averted without any extraordinary degree of exertion. In fields, however, this is not so easy: in a field where they are observed, it would perhaps, on some occasions, be found economical in the farmers of a district to contribute among them, so as to pay the damage that would arise to any particular person for having the whole crop of the field, in which they first began, destroyed at once, in order to prevent the insects from spreading further, and thus injuring the adjacent crops.

OF THE COCCUS, OR COCHINEAL INSECTS IN GENERAL.*

These are an extremely fertile race, and many of them are very troublesome in stoves and green-houses. The females fix themselves, and adhere almost immovably, to the roots, and sometimes to the branches, of plants. Some of them, having thus fixed themselves, lose entirely the form and appearance of insects: their bodies swell, their skin stretches and becomes smooth, and they so much resemble some of the galls or excrescences, found on plants, as by inexperienced persons to be mistaken for such. After this change the abdomen serves only as a kind of shell or covering, under which the eggs are concealed. Others, though they are likewise thus fixed, preserve the form of insects till they have laid their eggs and perish. A kind of down or cotton grows on their belly, which serves

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* In the Cochineal insects the beak is situated on the breast; and the antennæ are thread-shaped, or of equal thickness throughout. The abdomen is terminated by four or six light-coloured bristles. The male has two erect wings, but the females have none.

for the formation of the nest in which they deposit their eggs.

The males are very different in their appearance from the females. They are furnished with wings, and are small but active insects.

Most of the species of Coccus, which are found in, and infest our green-houses and conservatories, have been brought over, with exotic plants, from other climates.

THE LAC COCHINEAL*.

Mr. Kerr, who has given a minute account of these insects in the Philosophical Transactions, says, that he has often observed their birth, but could never see any of them with wings; nor was he ever able to remark any distinction in the sexes: owing, he confesses, most probably, to the minuteness of the objects, and the want of proper glasses.

They are produced from the parents in the months of November and December. For some time they traverse the branches of the trees upon which they are produced, and then fix themselves on the succulent extremities of the young shoots. By the middle of January they are all fixed in their proper situations, and, though they now exhibit no marks of life, appear as plump as before. The limbs, antennæ, and bristles of the tail, are no longer to be seen. Around the edges of their body they are environed

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* Description. The head and trunk seem to form one uniform, oval, compressed, red body, consisting of twelve transverse rings, and somewhat of the shape and size of a very small louse. The back is keel-shaped, and the belly flat. The antennæ are half the length of the body, filiform, and diverging, sending off two and sometimes three diverging hairs. The tail is a little white point, from whence proceed two horizontal hairs as long as the body.

Synonyms. Coccus ficus. *Linn.*—Gum Lac, in the East Indies.

with a sub-pellucid gelatinous liquid, which seems to glue them to the branch. The gradual accumulation of this liquid at length forms a complete cell for the insect, which takes place about the middle of March. The insect is now, in appearance, an oval, smooth, red bag, without life, about the size of a small American Cochineal insect, emarginated at the obtuse end, and full of a beautifully red liquid.

In October and November, twenty or thirty small oval eggs, or rather young grubs, are to be found within the red fluid of the mother. When this fluid is all consumed, the young insects pierce a hole through the external covering, and walk off one by one, leaving their nidus behind. This nidus is that white membranaceous substance found in the empty shells of the Stick Lac.

These insects are found on only four different kinds of trees, the principal of which are the *Ficus religiosa* and *Ficus Indica* of Linnæus.

They generally fix themselves in such numbers, and so close to each other, that scarcely more than one female in six has room to complete her cell: the others die, and become the food of various insects. The extreme branches of the above trees appear as if they were covered with a red dust, and their sap is frequently so much exhausted, that the adjoining parts wither away.—The sap of the trees seems much allied to the cell of the Coccus, so that it appears to have undergone very little change by its formation into these cells.

These Insects, which in the East Indies have the name of Gum Lac, are principally found on the trees of the uncultivated mountains on both sides of the Ganges, where nature has been so bountiful, that, were the consumption many times greater than it now is, the markets would be fully supplied. The only trouble is in breaking down the branches and carrying them to market.

The price, in the year 1781, of Gum Lac, in Dacca, was only twelve shillings for the hundred pounds weight, notwithstanding its being brought from a very great distance, as the greatest part of it is collected in Assam. The best Lac is of a deep red colour. If it be pale, and pierced at the top, the value diminishes, because the insects have left their cells, and consequently it can be of no use as a dye; though probably it may be of more value as a varnish.

Stick Lac is the natural state of this production. When the cells are separated from the sticks, broken into small pieces, and appear in a granulated form, they are called *Seed Lac*. This, liquified by fire and formed into cakes, is *Lump Lac*. When the cells are liquified, strained, and formed into thin, transparent laminæ, the substance has the name of *Shell Lac*.

Of the Shell Lac the natives of the Eastern countries make ornamental rings, to decorate the arms of the females. They also form it into beads, necklaces, and other female ornaments. This substance was formerly used in medicine, but it is now confined principally to the making of sealing-wax, and to japanning, painting, and dyeing.

THE AMERICAN COCHINEAL*.

This Cochineal, so useful, when properly prepared, to painters and dyers, is a native of South America, where it is found on several species of Cactus, particularly the

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* Description. The Cochineal Insect of the Brasils is convex, with legs of a clear bright red in both male and female, and the antennæ moniliform or bead-like. The male is a delicate and beautiful insect, the colour of the whole body a bright red, nearly resembling the pigment usually called red lake; the breast is elliptical, and slightly attached to the head. The antennæ are above

Cactus Opuntia, or Prickly Pear-tree. In Jamaica these insects are also now tolerably common, but they are generally understood to have been introduced from America. The heavy rains, however, which the West India islands are subject to, often render the industry of the natives in breeding and rearing them entirely fruitless.

When the young insects are arrived at their full growth, they adhere to the leaf of the Cactus in a torpid state; and it is at this period they are taken from the plant for use. Twice or thrice a week, the slaves appropriated to this employment go among the Cactus plants, and pick off carefully, with a bamboo twig, shaped somewhat into the form of a pen, every full-grown insect they can find, with many not yet arrived to their perfect state; the consequence of which is, that the plants are never half stocked with insects, many of the females being destroyed before they have deposited their young. The natives of Mexico pursue a method very different. As soon as the periodical rains are over, and the weather is warmer as well as drier, they fix on the prickles of the Cactus leaves small parcels of the finest moss, serving as nests, to contain, each, ten or a dozen full-grown female insects. These, in the course

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half the length of the body. The legs are of a more brilliant red than that of the other parts. Two fine white filaments, about three times the length of the insect, project from its belly or abdomen. The wings are two, erect, of a faint straw colour, and of a very delicate texture. The female has no wings, is elliptic in its form, and convex on both sides, but chiefly so on the back, which is covered with a white downy substance resembling the finest cotton. The abdomen is marked with transverse rugæ or furrows. The mouth is situated in the breast, having a brown beak, inclining to a purple tint, that penetrates the plant on which the insect feeds. Its six legs are of a clear bright red. *Barrow's Travels.*

SYNONYMS. Coccus cacti. *Linn.*—La Cochenille du Nopal, by the French.

of a few days, bring forth an innumerable tribe of young, spreading themselves over the leaves and branches of the plant, till they become attached to those spots which they find most favourable for supplying nutritious juices; where, soon acquiring their full growth, they remain motionless, and then are gathered off for use; a sufficient number being always left for the production of new broods.

The insects are soon converted into Cochineal, by a very simple process;—but if, *in corporeal sufferance, the poor beetle feels a pang as great as when a giant dies*, this process is not more simple than it is cruel. The insects, which were collected in a wooden bowl, are thickly spread from thence upon a flat dish of earthenware, and placed alive over a charcoal fire, where they are slowly roasted until the downy covering disappears, and the aqueous juices of the animal are totally evaporated. During this operation, they are continually stirred about with a tin ladle; and sometimes water is sprinkled upon them, in order to prevent absolute torrefaction, which would destroy the colour, and reduce the insect to a coal; but a little habit teaches when to remove them from the fire. They then appear like so many dark, round, reddish grains, and take the name of Cochineal, preserving so little the original form of the insect, that this precious dye was long known and sought in Europe, before naturalists had determined whether it was an animal, a vegetable, or a mineral substance.

It seems by no means improbable that a Cochineal, more pure than that which is produced from the insect, might be prepared from some of the plants on which it feeds. There is also no reason for supposing, that we might not likewise prepare it from some of our English species, which bear a great resemblance to those of Ame-

rica, if only a proper and judicious management was adopted.

It has been computed that there are imported into Europe, in the course of trade, no less than eight hundred and eighty thousand pounds weight of Cochineal annually.

THE EUROPEAN COCHINEAL*.

This species of Cochineal is among the various and valuable productions with which the beneficent hand of nature has enriched the dominions of Spain. Like the rest of the genus, it is found sticking to the branches and leaves of trees, particularly to those of a small species of oak about two feet high, the Quercus coccifera of Linnæus, that grows in Spain, Provence, Languedoc, and along the shores of the Mediterranean.

In the month of March it is to be seen in its first state, no bigger than a grain of millet, fixed to the tree and scarcely able to crawl. It soon becomes immovable: at this period it increases very much in size. It now bears considerable resemblance to a vegetable excrescence, being covered over with a down that adheres on all sides to the tree. Its figure is not unlike that of a small sloe. Its growth is completed in April, when it attains a round shape, and is about the size of a pea, of a reddish colour, and appearing as if filled with discoloured blood. Towards the end of May it is seen to be full of eggs, ranged under the belly in the down that covers its body. After laying its eggs here it soon dies, adhering still to its position, and

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* DESCRIPTION. The female is about the size of a pea, and of a violet colour.

SYNONYMS. Coccus Ilicis. *Linn.*—Grana Kermes. Scarlet Grain. *Dillon.*—Graine d'écarlate, in France.

rendering to its progeny a further service, by shielding them from the inclemency of the weather, and the hostile attacks of other insects. Each of the females will sometimes produce so many as two thousand young ones.

The poor people of many of the provinces obtain a subsistence by collecting these insects for sale; and, in order to pick them off the branches with greater facility, many of them suffer the nails of their fingers to grow to a great length. In some years, a sum amounting to little less than thirty thousand dollars, (five thousand pounds sterling,) has been produced to the inhabitants of one district in Spain, from the sale of this insect. But being used only as an ingredient in dyeing purple, it has been much neglected since the introduction of the American Cochineal.

THE COCCUS OR COCHINEAL OF THE PEACH TREE*.

When the Coccus which infests the peach-tree has attained its full growth, its whole body is filled with eggs, and on dissection it will be found that scarcely any viscera are perceptible. The number of eggs sometimes amounts to three or four thousand. These are still retained under the shell of the insect, which now, beneath, assumes a con-

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* Description. The female is of a brownish colour. Its upper surface or back is hard, like a kind of shell; and its under surface is a soft skin, which applies close to the tree, and on it are observable the traces of legs. A cotton-like substance appears at first all round the edge, as a kind of cement, to join it there to the tree.—The male is a fly, about one fourth the size of the female. It has two long antennæ, six legs, and wings which are at least twice the length of the body. The abdomen terminates in a pointed kind of tail, on each side of which there is a slender white filament, twice as long as the wings. It is of a deep red colour, except the wings, which are of a dirty white, bordered with a stripe of bright red.

Synonym. Coccus Persicæ. *Linn.*

cave form. The animal, after having performed, with the operation of continuing its species, all the functions that nature intended, ceases to exist. After death it remains fixed in the same place, and serves as a covering to protect the eggs until they are hatched, and the young brood, until their members have attained the necessary degree of strength to enable them to perform their allotted functions.

The whole brood are not hatched at one instant; but the eggs that were first laid become first vivified, and the young ones no sooner feel their animal powers, than they begin to look about for food. At this period of its existence the young insect is an active little creature, of an oblong shape and whitish colour, that runs about every where with great celerity. It continues active only for a few days, after which it fixes itself to some tender part of the tree; in general, to the leaves or young shoots of the same year, for it is usually brought to life in the month of May. After it has thus attached itself it remains, without motion, under the appearance of a thin whitish scale.

The creature, however, possesses a loco-motive faculty for many months, probably all the while that it continues in its larva state. A person desirous of setting it in motion has only to pluck off some of the leaves on which these insects have fixed themselves, and to lay them in any place to wither. So long as they remain fresh and succulent, the insects continue without motion; but when the leaves begin to shrivel, the larvæ will quit their hold, abandon the leaves, and go in search of food elsewhere. In the autumn, therefore, the insects that are attached to the leaves, change their situation for the tender and succulent parts of the bark, especially of the young shoots, and still more particularly the tenderest tops of these shoots. Here they may often be found in such numbers as almost to cover the whole.

In this state they remain during the winter, still making

some advances in growth. But it is not until the month of April, after it has cast its last skin, that the insect assumes its perfect state. From this period the females entirely lose their loco-motive powers; and, even if the branch to which they adhere be cut off, they will not attempt to quit it, but must inevitably perish.

The male, when it quits the larva state, is, like the others of its tribe, furnished with wings. After a short but active life, it dies without even tasting food, being apparently provided with no organs adapted to this purpose. These flies generally appear towards the end of April or the beginning of May.

The eradication of this species from our fruit gardens is an object of no inconsiderable importance; and, from a careful attention to their transformations and habits, it appears to be by no means a difficult task. If the twigs were carefully brushed early in the spring, with a hair brush, in the direction of the buds, many of them might be detached, and thus their numbers would be greatly reduced. Where the insects are very numerous, and where, of course, they are placed very close together, at the points of the twigs, these points might be cut off, and carried out of the garden. If exceedingly numerous, all the young twigs might be cut out. In this case, it is true, the fruit will, in a great measure, be lost for that season; but the tree will be thrown into such health, as to be in the finest possible order for the ensuing year. After all this has been done, however, the tree ought still to be examined about the beginning of May next season; by which time the female Coccus, having attained its greatest size, will become easily perceptible, when each of them should be carefully removed by means of a blunt knife, having a very thin blade, and carefully deposited in a vessel, for the purpose of being carried out of the garden. With each female which is destroyed at this period, it is supposed that at least 3000 eggs are also destroyed.

THE COCCUS OR COCHINEAL OF THE APPLE TREE *.

There is, says Dr. Anderson, in his Recreations in Agriculture, an insect belonging to the Coccus tribe, which has of late multiplied extremely in the nurseries about the metropolis, and which, unless carefully guarded against, threatens to be extremely destructive to our orchards every where. It lives upon the apple-trees, and, like most of the insects of this kind, throws out such a quantity of cotton-like matter, as sometimes to cover every twig of the young trees, as if they had been rolled up in cotton.

The history of this insect is still involved in obscurity; and the changes it undergoes, their periods, and its modes of life during the various stages of its existence, are not yet distinctly known. The following circumstances relating to it, are, however, related by Dr. Anderson.

Wherever this insect has fixed itself upon a tree, it communicates a corrosive ichor, that affects the tree after the insect itself is removed, like a kind of gangrene, so that the tree becomes blotched, uneven in the bark, and full of deep holes that soon occasion its decay and death. The insect fastens itself, by preference, upon the tender buds of young trees, immediately under the axillæ of the leaves on the shoots of that year, and very quickly infects them. It, however, takes such slight hold, that if it has not had time to bury itself in holes in the bark, it may be easily brushed off by means of a firm, dry painter's brush; so that the shoot shall sustain no damage from it. Rain also washes it off from smooth surfaces; and, during moist weather, a wet brush may be efficaciously employed for the same purpose.

Next to the eyes on the young shoot, this insect is found

* Coccus mali.

to establish itself in any cavities in the stems or larger branches of trees, which have been produced by tearing off the branches incautiously, or in any other wound in the bark. In these irregular cavities it finds a protection from rain; and from thence, when the insects are once established, it is very difficult to dislodge them; so that these cavities may be considered as the nests from which they send out swarms to spread over the young branches. It would be a great preventive against their attacks, to scoop out all such cavities to the quick; to cut off all irregular prominences; to scrape off the loose scales from the bark, and then to cover it with the composition invented by Mr. Forsyth, would not only destroy the insects, but by bringing on a smooth, clean bark, would admit of its being afterwards washed and cleaned without difficulty.

Lepidopterous Insects*.

The present order contains only three tribes; the Butterflies, Sphinges, and Moths. These are all produced from caterpillars, by a change that is common to all the insect species. The caterpillars proceed from eggs; and those of the Butterflies, in particular, are so numerous, that in the spring of the year, the leaves and tenderest stems of plants are sometimes perfectly crowded with them.

Caterpillars are, in general, extremely voracious, some of them eating more than double their own weight in a day, without suffering any inconvenience from it; for the digestive powers of all animals are proportioned not so much to their size, as to the duration of their lives.

They often change their skin without materially altering their shape, till at last they put on one very different from all the rest. In this state they have the name of Aurelia or Chrysalis; and in it all the parts of their future form are visible, but so very soft and delicate, that the

* The insects of the Linnean order *Lepidoptera,* have four wings, each covered with fine scales, apparently like fine powder or meal. Their bodies are composed in general of twelve membranaceous rings, which sufficiently distinguish them from all such creatures as bear the least resemblance to them. Their head is scarcely to be distinguished from the body, but by its containing an opening, in which are two jaws, each armed with a large and thick tooth. The number of their feet varies with their size and form. Along the sides are arranged holes or tracheæ, through which they breathe.

least touch discomposes them. Though dormant and entirely helpless, all their members are now completely formed, and they only wait the acquisition of a shell to defend them from external injuries, and suffer them to commence their flight.

The production and manners of these, in this state, imperfect animals, afford much matter both for amusement and instruction.

About the middle of summer a butterfly deposits from three to four hundred eggs on the leaf of a tree, from each of which, in a few days, a young caterpillar proceeds. The eggs are no sooner hatched, than the young ones begin to form a common habitation. They spin silken threads, which they attach to one edge of the leaf and extend to the other. By this operation they make the two edges of the leaf approach each other, and form a cavity resembling a hammock. In a short time the concave leaf is completely roofed with a covering of silk. Under this tent the animals live together in mutual friendship and harmony. When not disposed to eat or to spin, they retire into their tent. It requires several of these habitations to contain the whole. As the animals increase in size, the number of their tents is augmented. But these are only temporary and partial lodgments, constructed for mutual convenience, till the caterpillars are in a condition to build one more spacious, which will be sufficient to contain the whole. After gnawing one-half of the substance of such leaves as happen to be near the end of some twig or small branch, they begin their great work. In constructing this new edifice or net, the caterpillars encrust a considerable part of the twig with white silk. In the same manner they cover two or three of such leaves as are nearest to the termination of the twig. They then spin silken coverings of greater dimensions, in which they enclose the two or three leaves together with the twig. The

nest is now so spacious, that it is capable of containing the whole community, every individual of which is employed in the common labour. These nests are too frequently seen in autumn upon the fruit-trees of our gardens. They are still more exposed to observation in winter, when the leaves which formerly concealed many of them are fallen. They consist of large bundles of white silk and withered leaves, without any regular or constant form. Some of them are flat, others roundish; but none of them are destitute of angles. By different plain coverings, extended from the opposite sides of leaves and of the twig, the internal part of the nest is divided into a number of different apartments. To each of these, which seem to be very irregular, there are passages by which the caterpillars can either go out in quest of food, or retire in the evening, or during rainy weather. The silken coverings, by repeated layers, become at last so thick and strong, that they resist all the attacks of the wind, and all the injuries of the air, during eight or nine months.

About the beginning of October, or when the frost commences, the whole community shut themselves up in the nest. During the winter they remain immovable, and seemingly dead; but, when exposed to heat, they soon discover symptoms of life, and begin to creep. In this country they seldom go out of the nest till the middle or end of April. When they shut themselves up for the winter they are very small; but, after they have fed for some days in spring upon the young and tender leaves, they find the nest itself, and all the entrances to it, too small for the increased size of their bodies. To remedy this inconvenience, these creatures know how to enlarge both the nest and its passages, by additional operations accommodated to their present state. Into these new lodgings they retire, in order to screen themselves from the injuries of the weather, or to cast their skins. In

fine, after casting their skins several times, the time of their dispersion arrives. From the beginning to nearly the end of June, they lead a solitary life. Their social disposition is no longer felt. Each of them spins a pod of coarse brownish silk. In a few days they are changed into chrysalids, and in eighteen or twenty days more are transformed into butterflies.

The modes adopted by caterpillars to screen themselves from observation, are as various as they are interesting. Many of them feed enclosed within the stems of herbaceous plants; others in the branches or trunks of trees; a few within fruits and the buds of flowers; some on the roots of plants; others again float on the surface of the water, between the leaves of aquatic vegetables, woven around them with inimitable art; and a very great number escape our notice, by taking their nourishment only in the night. And though many feed on the leaves of plants and trees in the day-time, yet some, as if conscious of the similarity of their colour to that of the undersides of the leaves, and of the safety they derive from attaching themselves thereto, are seldom to be seen but in that situation. Many of the moths, whose colours bear resemblance to those of the trunks or branches of trees, frequently fix themselves there, and remain motionless for several hours together. In these situations, a person unaccustomed to them, would not hesitate to pronounce them, from a little distance, the mere rugosities of the bark.

These various modes of eluding our sight, added to the uncertainty of breeding many species when procured, have prevented our being acquainted with the larvæ of the far greater part of the lepidopterous insects.

OF THE BUTTERFLIES IN GENERAL*.

These elegant insects feed on the nectar of flowers, and the moisture exuding from plants and trees, which they extract by means of their long proboscis or tongue. Their *caterpillars* are sometimes smooth, and sometimes thickly covered with hair; and their *chrysalids* are naked, and attached, apparently in a lifeless state, to trees or other substances, by filaments proceeding either from the tip or the middle of their bodies.

THE LARGE WHITE BUTTERFLY †.

This is a common species, and often, in its caterpillar state, very destructive to our cabbage and cauliflower plants. The caterpillars seem almost confined to these vegetables, on which they are generally to be found in great numbers from June to October. The Butterflies first appear on wing in the middle of May, and, about the end of the same month, lay their eggs in clusters on the under sides of cabbage leaves. In a few days the caterpillars come forth, and continue to feed together till the end of June, when they are at their full growth. They then traverse about in search of convenient places to fix

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* The antennæ of these insects are thicker towards the tip than in any other part, and generally end in a knob. The wings, when at rest, are erect, the upper edges meeting together over the body. They are entirely diurnal animals.

† Description. The general colour of this Butterfly is white, but the male differs from the female in having a few dark spots on his wings.

Synonyms. Papilio Brassicæ. *Linn.*—Large Garden White Butterfly. *Harris.*

themselves, where, after their change, the chrysalis may be sheltered. When such are found, they each fasten their tail by a web, and carry a strong thread of the same round their body near the head; and, thus firmly secured, hang a few hours, when the chrysalis becomes perfectly formed, and divested of the caterpillar's skin. In fourteen days after this, the fly is on the wing. The caterpillars of this latter brood arrive at full growth, and change to chrysalids in September, in which state they remain through the winter, till the beginning of the following May. During this time we often see them hanging under the copings of garden walls, under pales, and in other places, where they can have tolerable shelter from the inclemency of the weather.

The most effectual way of clearing the cabbage and cauliflower plants of caterpillars, is to send children into the gardens, as soon as they appear in any numbers, to pick them off, and destroy them. This may seem a troublesome and expensive mode, but it has been found to answer, even to the extent of clearing many acres of field cabbages.

THE PURPLE EMPEROR *.

This is the most beautiful and most interesting of all the British Butterflies. In his manners, as well as in the varying lustre of his purple plumes, says Mr. Haworth, he possesses the strongest claims to our attention.

It is in the month of July that he makes his appearance

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* DESCRIPTION. The wings are indented, and of a rich brown colour, with a blue gloss, and have a whitish interrupted band on each side. On the upper part of the under wings there is an eye-like spot.

SYNONYMS. Papilio iris. *Linnæus.*—Le Mars. *Tigny.*

in the winged state, and he invariably fixes his throne upon the summit of some lofty oak, from the utmost sprigs of which, in sunny days, he performs his aërial excursions. "In these," continues this writer, "he ascends to a much greater elevation than any insect I have ever seen, sometimes mounting even higher than the eye can follow, especially if he happen to quarrel with *another Emperor*, the monarch of some neighbouring oak. These insects never meet without a battle, flying upward all the while, and combating furiously with each other: after which they frequently return to the identical sprigs from which they each ascended.

"The Purple Emperor commences his aërial movements from ten till twelve o'clock in the morning, but does not perform his loftiest flights till noon; decreasing them, after this hour, until he ceases to fly, about four in the afternoon."

The females, like those of many other species, are rarely seen on wing. The reason of which is not only interesting, but is little known. It is their being destitute of a certain *spiral socket*, which the males possess, near the base of the main tendon of their upper wings. This socket receives and works a strong elastic *spring*, arising from the base of the under wings; thereby enabling them to perform a stronger, longer, and more easy flight than it is possible for the females to do.

The males, as before stated, usually fly very high, and are only to be caught by means of a bag-net, fixed to the end of a rod twenty or thirty feet long. There have been instances, though they are rare, of their settling on the ground near puddles of water, and being taken there. When the Purple Emperor is within reach, no insect is more easily caught; for he is so bold and fearless, that he will not move from his settling place until quite pushed off.

The caterpillar is green, with oblique white lines. It

is rough on the upper part of the body; and on the head there are two spines. It feeds on the oak.—The chrysalis is green, has two horns, and is somewhat compressed.

THE PEACOCK BUTTERFLY *.

The caterpillars of this Butterfly, are produced from eggs which have been deposited in the spring of the year on the nettle. They live in society, and are to be found, throughout the early part of the summer, feeding on this plant. They are black, and their bodies are covered with spines, and marked with numerous small white specks.

Shortly after the little animals first see the light, they begin to spin for themselves a large and commodious web, into which they flee for shelter during rainy weather, and in the night; and under the protection of which they change their skins.

When they have attained their full growth, they seek out some proper place where they can safely take their chrysalid form. In doing this they suspend themselves vertically, with the head downward; and the chrysalis, thus suspended, continues for about twenty days, about the end of which time the insect becomes perfected, breaks out from its shell, and flies away.

In the south of England the Peacock Butterfly is sufficiently common; but it is extremely rare in the north. In the county of York it is not known to have been more

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* DESCRIPTION. The wings are angular and indented, of a brownish red colour, with black spots. There is a large blue eye-like spot on each; and on each of the upper wings there are two black spots.

SYNONYMS. Papilio Io. *Linnæus.*—Le Papillon Paon du Jour. *Tigny.*

than twice caught. During the winter it conceals itself, and does not die until after it has deposited its eggs in the ensuing spring.

THE MARSH FRITTILLARY *.

The caterpillars of this insect are to be seen, in some particular situations, in September, in great abundance. They keep together under the cover of a fine web, which they spin to defend themselves from the inclemency of the weather; and in the protection of this they pass the winter months. During this time they are so nearly reduced to a torpid state, as to require no food, nor do they venture out of their general covering till invited by the warmth of the spring. As they afterwards increase in size, they spread abroad in search of food; but their local attachment is very remarkable, for neither the caterpillar, nor even the butterfly, will stray far from the place where it was bred. Numbers of the latter may sometimes be observed on wing in a small spot of swampy or marsh land, when not one of them is to be met with in any of the adjacent places. As they fly very low, and frequently settle, the naturalist has no difficulty in catching them. The caterpillars are generally at their full growth about the last week in April: when this takes place, they sus-

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* Description. The Marsh Frittillary is a small butterfly, not more than an inch and a half across the broadest part of its expanded wings. Its colour is a brownish orange, variegated with yellow and black, in a small pattern. The under sides of the wings are lighter, and chiefly orange and yellow. It is sometimes called Greasy or Dishclout Frittillary, from these under sides having always a greasy appearance.

Synonyms. Papilio artemis. *Fabricius.*—Greasy Frittillary, or Dishclout. *Harris. Haworth.*—Marsh Frittillary. *Lewin.*

pend themselves by the tail to change into chrysalids, in which state they remain about fourteen days. Their mode of suspension is a singular instance of the extraordinary power of instinct. They first draw two or three small blades of grass across towards their top, and fasten them together by means of their silk; then hang themselves beneath the centre of these, each having his own little canopy. By this means they are not only hidden from the sight of birds, but defended in a great measure from the damage they might otherwise sustain from windy and boisterous weather. They feed on the Devil's-bit Scabious, (*Scabiosa succisa,*) and on various kinds of the marsh grasses; eating only the opening leaves as they come up, which renders them sometimes difficult to find. This they do also only while the sun shines; for if, in the very act, the sun becomes hidden by a cloud, they immediately cease, but, on the return of the sun-beams, they recommence their operations with great voracity.

If any person wishes to observe the operations and change of these caterpillars at his own home, he has nothing more to do than to cut a turf from the place where they are found, and they will feed as readily there as in their former residence.

THE NETTLE TORTOISE-SHELL BUTTERFLY*.

These Butterflies make their earliest appearance, in a winged state, about the month of April. They are short-

* DESCRIPTION. The upper wings of this well-known insect, one of the most beautiful and most common of the British Butterflies, are red, and marked with alternate bands of black and pale orange; below these are three black spots, the inner one of which is square; and near the extremity of their upper parts is a white

lived, laying their eggs in the beginning of the following month, in great numbers, on the uppermost stalks of the nettles, and dying very shortly afterwards.

The eggs adhere by means of the glutinous moisture with which they are covered when first protruded. About the middle of the month the young caterpillars may be seen, of a light green colour, on the nettle-tops, enclosed in a web that covers the whole upper part of the plant; and in this they all herd together. They soon cast their first skin, when they always remove to a fresh place, leaving their old coverings hanging to the web. Here, at a little distance from their former habitation, they form a new colony. In their third skin they make another remove, but still keep together in a web. On changing this they also change their colour, and become black; and as they have now increased too much in size to live in one society, they separate into companies. In their sixth or last skin they entirely separate; and in this state they often make such ravages among the nettles, as to leave nothing but the stalks and fibres. Sometimes they are seen so numerous, as to cover all the tops, and six or seven inches of the stalks, giving them the appearance of being enveloped in black cloth.

About the beginning of June they are arrived at their full growth; when, fastening their tails by a web under the nettle-leaves, or to the stalks, they change into chrysalids. These are at first green, but in a day or two they change to a bright gold, or else to a greenish brown colour. They remain thus for about twenty days, when

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stripe. The lower wings are also red, marked with a large black patch at the base. The margins of all of them are black, with blue spots.

SYNONYMS. Papilio Urticæ. *Linn.*—Nettle Tortoise-shell. *Lewin.*—Tortoise-shell Fly. *Harris.*—Small Tortoise-shell. *Haworth.*

they become Butterflies. Some few of this second brood live through the winter, being frequently found in a state nearly torpid in that season.

These insects, in common with some others of the same family*, soon after their enlargement from the chrysalis state, discharge a few drops of reddish fluid, which, in places where they have been in great numbers, has had the appearance of a *shower of blood*, and been recorded by writers as the forerunner of some extraordinary event. The first discovery of this circumstance that has been recorded, is related by M. de Reaumur. He says, that in the beginning of July, 1608, the people of the town of Aix were in the utmost alarm, from what they thought a shower of blood, that had just fallen in the suburbs, and for some miles round the place. M. de Peiresc, a philosopher, who, among other kinds of knowledge, had not neglected that of the operations and economy of insects, was consulted on the subject. He found the walls of a church-yard near the place, and the walls of several small villages in the neighbourhood, to be spotted with large drops of a blood-coloured liquid. A little time before this he had happened to pick up a large and beautiful chrysalis, which he had carefully laid a box. Immediately after its transformation into the butterfly state, he remarked that it had left a drop of blood-coloured liquor on the bottom of the box, and that this drop or stain, was as large as a French sol. The red stains on the walls, on stones near the highways, and in the fields, were found to be perfectly similar to that left on the bottom of the box. M. de Peiresc now no longer hesitated to pronounce that all those blood-coloured stains, wherever they appeared, proceeded from the same cause. The prodigious number

* *Papilio atalanta, P. Io, P. Polychloros, &c.*

of butterflies, which he, at the same time, saw flying in the air, confirmed his original idea. He likewise observed that the drops of the miraculous rain were never found in the middle of the town; that they appeared only in places bordering upon the country; and that they never fell upon the tops of houses, or upon walls more elevated than the height to which Butterflies generally rise. What M. de Peiresc saw himself, he showed to many persons of knowledge or of curiosity, and established, as an incontestable fact, that the pretended drops of blood were in reality but drops of a red liquid deposited there by Butterflies. It is also deserving of remark, that all the showers of blood that have been recorded to have happened, took place in the warm seasons of the year, when the Butterflies are most numerous.

OF THE SPHINGES OR HAWKMOTHS.*

The bodies of these insects are usually thick and heavy, and their wings long and admirably calculated for rapid flight. Some of them are among the largest of the Lepidopterous Insects. They fly, for the most part, early in the morning, and late in the evening. They hover over flowers, and, without settling upon them, suck out their nectarious juices by means of their long and spiral tongue.

Their caterpillars are large, smooth, and without hairs, and furnished with a single erect horn near their posterior extremity, the peculiar uses of which are not known. The greater part of the species change into chrysalids under the surface of the ground.

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* The antennæ are of a somewhat prismatic shape, tapering at each end. The tongue, in most of the species, is exserted. There are two feelers. The wings are in general deflected.

THE DEATH'S-HEAD HAWKMOTH *.

The name of this moth has been derived from the circumstance of its having upon the thorax somewhat the appearance of a human skull. It is the largest of all the British species, the wings of the females measuring sometimes more than five inches in extent.

When taken into the hand, this Moth makes a singular kind of noise, by striking its palpi against the tongue; and may thus be considered as, in some measure, endowed with a voice. The sound which it emits has, by some persons, been compared to the plaintive squeaking of a mouse.

These Moths generally make their first appearance about the end of September or beginning of October, flying abroad only in the evening, and again at break of day. During one year, in which the inhabitants of Bretagne suffered dreadfully from an epidemic disease, the Death's-head Hawkmoths were observed in immense numbers. The superstitious, struck with the singular appearance of their thorax, immediately attributed the sufferings of the people entirely to the visitation of these insects. And their plaintive cry, when taken up, tended greatly to confirm this error.

The plant which these Moths chiefly prefer, as that on which to deposit their eggs, is the potato. The caterpillars, even when full grown, though of immense size, being

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* Description. The wings are entire; the lower ones yellowish, with two brown bands. The abdomen is yellowish, with black belts; and on the thorax there is a mark, bearing a fanciful resemblance to a human skull.

Synonyms. Sphinx atropos. *Linnæus*.—Le Sphinx tête de Mort. *Tigny*.

sometimes more than three inches in length, and of the thickness of a man's finger, are seldom to be observed, from the circumstance of their either retiring under the ground, or artfully concealing themselves beneath the leaves in the day-time, and coming abroad only in the evenings to feed.

Several persons have attempted to feed the caterpillars, for the purpose of thereby obtaining specimens of the insect in its perfect state. But although they have diligently attended to them, and the insects have completed their transformation into chrysalids, I have not yet heard of any one who was able to rear them up to the winged state. I have myself made numerous attempts, but have invariably failed. "Perhaps," says Mr. Haworth, "in a state of nature, they may perform their metamorphoses deeper in the ground, and consequently, in a more moist and equal temperature, than that required by most other Lepidopterous Insects; and if so, the cause of their perishing in our breeding-cages, is undoubtedly owing to their having, in those cages, too scanty and too dry a soil."

*OF THE MOTHS IN GENERAL**.

The Moths are only to be seen flying abroad in the evening and during the night, which are their times of feeding. The larvæ or *caterpillars* are mostly smooth, and more or less cylindrical: they are active creatures, and prey with great voracity on the leaves of various plants. Their *chrysalids* are either concealed in the ground, or protected from the inclemency of the weather by a silky covering, spun by the larvæ round their bodies.

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* The antennæ gradually taper from the base to the tip. The tongue is spiral, and the wings, when the animals are at rest, are generally deflected.

In this state they are either simple, or have a kind of hook at their extremity.

THE SILKWORM*.

The Silkworm is found, in a native state, on mulberry-trees, in China and some others of the eastern countries, from whence it was originally introduced into Europe, in the reign of the Emperor Justinian. It is, however, at this time become, in a commericial view, one of the most valuable of all insects; affording those delicate and beautiful threads, that are afterwards woven into silk, and used in garments in almost all parts of the world.

In the warmer climates of the East, the Silkworms are left at liberty upon the trees; where they are hatched, and on which they form their coccoons: but in cooler countries, where these animals have been introduced, they are kept in a room with a south aspect, built for the purpose, and fed every day with fresh leaves.

The eggs are of a straw colour, and each about the size of a pin's head. At its birth the larva or worm is entirely black, and about as long as a small ant; and it retains this colour eight or nine days. The worms are put on wicker shelves, covered first with paper, and on this with a bed of the most tender of the mulberry-leaves. Several ranges are placed, one above another, in the same chamber, about a foot and a half apart. The scaffolding for these ranges should, however, be in the middle of the room, and the shelves not too deep. The worm continues feeding during eight days after its birth, when it becomes about a fourth of an inch in length: it then experiences a kind of lethargic

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* SYNONYMS. Phalæna (bombyx) mori. *Linn.*—Bombyx mori. *Fabricius.*

sleep for three days, during which it casts its skin. It now feeds for about five days, and is considerably increased in size, when a second sickness comes on. In the next ten days it experiences two other attacks; by which time it has attained its full growth, and is somewhat more than an inch in length, and two lines in thickness. It then feeds, during five days, with a most voracious appetite; after which it refuses food, becomes transparent, with a tinge of yellow, and leaves its silky traces on the leaves that it passes over. These signs denote that it is ready to begin its coccoon, in which it is to undergo its change into a chrysalis.—The animals are then furnished with little bushes of heath or broom, stuck upright between the shelves: they climb up the twigs, where, after a little while, they begin the foundation of their lodge, and are five days in spinning the coccoon. They generally remain in this state about forty-seven days.

The retreat which they thus form is a cone or ball of silk, spun from two longish bags that lie above the intestines, and are filled with a gummy fluid of a marigold colour. The apparatus with which the animal is furnished for spinning the silky threads that principally compose this bag, resembles, in some measure, a wire-drawer's machine, in which gold or silver threads are drawn to any degree of fineness; and through this the animal draws its thread with great assiduity. As every thread proceeds from two gum-bags, it is probable that each supplies its own; they, however, are united as they proceed from the animal's body. If we examine the thread with a microscope, it will be found flattened on one side, and grooved along its whole length. Hence we may infer that it is doubled just upon its leaving the body, and that the two threads stick to each other by the gummy quality they possess.

In a state of nature, the Silkworm, previous to the spinning of its web, seeks out some convenient place to erect

its cell without obstruction. When it has found a leaf, or a chink fitted to its purpose, it begins to writhe its head in every direction, and fastens its threads on every side to the walls of its retreat. These, being continued, form at length the little oval ball in which it is to undergo its change.

The exterior of the coccoon is composed of a kind of rough cotton-like substance, called floss; within this the thread is more distinct and even; and next the body of the aurelia, the apartment seems lined with a substance of the hardness of paper, but of a much stronger consistence. The thread which composes the coccoon, is not rolled regularly round, but lies upon it in a very irregular manner, and winds off first from one side, and then from the other.

In the course of six or seven days all the coccoons are generally formed: they are then taken off the branches of heath, and divided into classes. The best are strong, and of a pure, unspotted colour. Some are white, and others yellow. The good ones are firm and sound, of a fine grain, and have both ends round and strong. Those of a bright yellow yield more silk than the others. But the pale ones are preferred, because they take certain colours better, and because, since they contain less gum than the others, they lose less than those in boiling.

Five or six days after the coccoon has been detached from the branches, the birth of the moth is prevented, as this would otherwise pierce the shell, and thereby render the coccoon useless. To prevent this the coccoons are put into long, shallow baskets, covered up, and baked for about an hour, in a heat equal to that of an oven from which the bread is just drawn.

After the baking they are disposed in a proper manner on osier shelves, distributed into stories, two or three feet distant from each other.

The whole thread, if measured, will be found about

three hundred yards long; and it is so very fine, that eight or ten threads are generally rolled off into one by the manufacturers. For this purpose the coccoons are put into small coppers or basons of water, each over a small fire. The ends of the threads are found by brushing them over gently with a whisk made for the purpose; and in the winding they are each passed through a hole, in an horizontal bar of iron placed at the edge of the bason, which prevents them from becoming entangled.

It is generally a fortnight or three weeks before the insect within the coccoon is changed into a moth; but no sooner is it completely formed, than, having divested itself of its aurelia skin, it prepares to burst through its prison. For this purpose it extends its head towards the point of the coccoon, and gnaws a passage through its cell, small at first, but enlarging as the animal increases its efforts for emancipation. The tattered remnants of its aurelia skin are left in confusion within the coccoon, like a little bundle of dirty linen.

The animal, thus set free, appears exhausted with fatigue, and seems produced for no other purpose than to transmit a future brood. The male dies immediately after its conjunction with the female; and she only survives him till she has laid her eggs, which are to be hatched into worms in the ensuing spring.

In many parts of Italy the inhabitants contrive to have two silk harvests in the year. They keep the eggs in very cool places; and, when the mulberry trees (after having been stripped entirely of their leaves for former worms) begin to bud a second time, they expose the eggs to be hatched.

During the whole time in which the animals continue in a worm state, the utmost care and attention are necessary, as they are extremely susceptible of cold, dampness, and unpleasant smells.

THE GOAT MOTH *.

The Caterpillar of this moth inhabits the interior of decayed trees, particularly of the willow and poplar, and continues in this state for three years before it undergoes its change to a chrysalis. The parent moth deposits her eggs on the bark of the tree, and the larva, as soon as it is hatched, gnaws its way, through the bark, into the interior. Its jaws are extremely powerful.

This is one of the species of Lepidopterous insects which possess properties injurious to mankind during the larva state. They do considerable damage by their boring, in various directions, into the trunks of young willow trees, and there feeding upon the wood and pith; oftentimes weakening the tree so much as to cause its easy overthrow by the first storm that afterwards occurs.

In this state they have a strong and disagreeable odour, occasioned by an oily liquid which they emit from their mouth. It is supposed that this liquid is of use in moistening the wood, and thus preparing it for the operation of the insect's jaws.

The insect changes into a chrysalis in the interior of the tree; where it spins a nidus of loose texture, composed of the sawdust of the tree, mixed with the silk which it produces from its own body. In this state it continues about forty days, before it is perfected.

Mr. Haworth, in his Lepidoptera Britannica, states, that, probably, the best mode of preventing the mischief occa-

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* Description. The wings of this moth are of a deep and clouded grey, marked with a great number of small blackish waves. The thorax has an angulated band of black on its posterior part.

Synonyms. Phalæna (bombyx) cossus. *Linn.*—Bombyx cossus. *Haworth.*—Cossus ligniperda. *Fab.*—La Rongeuse de Bois. *Cuvier.*

sioned by these insects, would be to search for and destroy the sluggish females, at the end of June; since, from their large size, they would readily be found sticking upon the trees near the infected parts.

THE BROWN-TAIL MOTH*.

In the years 1780, 1781, and 1782, the attention of the public, says Mr. Curtis, in his History of this insect, was strongly excited by the unusual appearance of infinite nnmbers of large white webs, containing caterpillars, which were conspicuous on almost every hedge, tree, and shrub, in the vicinity of London. Much alarm was excited in the minds of the superstitious, the weak, and the timid. Many persons, absurdly enough, supposed them to be a presage of the plague; and others asserted that their numbers were so great, that they would render the air pestilential, and would destroy every kind of vegetable, and starve the cattle in the fields. Some idea may be formed of their numbers, from the statement made by Mr. Curtis, that in one day four-score bushels were collected, for the purpose of being burnt, in the parish of Clapham. They chiefly abounded on the hawthorn, the oak, elm, black-thorn, rose-trees, brambles, and fruit-trees.

These moths come out of the chrysalis about the beginning of July, at which time they may be found flying about slowly, especially in the evening, and depositing their eggs on the foliage of the above-mentioned trees and

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* DESCRIPTION. The wings of this Moth are white. The rays of the antennæ are ferruginous; and the abdomen is terminated with brown hairs.

SYNONYMS. Phalæna (bombyx) phæorrhæus. Bombyx phæorrhæus. *Haworth.*—Brown-tail Moth. *Curtis's Short History of the Brown-tail Moth.*

shrubs. The caterpillars are hatched early in the autumn. As soon as they have quitted the egg, they set about spinning a web; and having formed a small one, they proceed to feed on the foliage, by eating the upper surface of the leaf, and leaving only the under side and ribs. It is curious to observe with what regularity they marshal themselves for this purpose. Thus they proceed, daily spinning and enlarging their web, into which they always retreat at night, and in bad weather, for shelter and protection. In the course of a few weeks their operations begin to be visible on the trees. Their web is not, however, so conspicuous as those leaves, which, being stripped of their green part, assume a dead appearance.

At this period the insects are easily destroyed, as the entire nest may at once be cut off with a pruning knife, a sharp hook, or a pair of gardener's shears. And it is stated that no remedy short of the actual removing of the webs, and burning or crushing the insects, will avail. Lotions, fumigations, and various kinds of vermin-powder, have been applied, but all to no purpose. They are too strongly enveloped in their webs to be affected by any of these.

In about three weeks from their being first hatched, they change their skins, a process which, like other caterpillars, they undergo four or five times, at different periods of their growth. This usually takes up several days. Afterwards they proceed, as before, enlarging their web, and extending their daily foraging excursions, until the winter comes on, when they are confined entirely to their silken habitation. They now not only secure the general web on all sides as strongly as they can, in order to exclude impertinent intruders, but each individual spins a case for itself. Here they rest in a state of torpid security, until the genial warmth of spring animates them afresh, and informs them that the all-bountiful Author of Nature hath provided the "food convenient for them." Thus

apprized, they issue forth in the day-time, and in fine weather, as before; but having acquired stronger powers, and the foliage they now have to encounter being more tender, they become less scrupulous in their feeding, and devour the whole of it.

A disposition to associate usually continues with them until they have changed their last skins, when they separate, each endeavouring to provide, in the best manner it is able, for itself. A few of them, however, are sometimes found continuing together to the last, when each spins a separate web, in which it changes to a chrysalis. This usually takes place about the beginning of June. Here, in a state of perfect quietude, it remains about three weeks, until it undergoes its final change.

These insects are so common in England, as to be found, every year, in considerable abundance; but the cause of the unusual increase of them in the years above-mentioned cannot satisfactorily be accounted for, and will, perhaps, be for ever concealed from our knowledge.

THE BARRED TREE LACKEY MOTH *.

Towards the conclusion of autumn, and before the fall of the leaf, the females of this species deposit their eggs, in a very beautiful ring, round the tender twigs of apple trees. These eggs are arranged in fifteen or twenty spiral rows, in close and symmetrical contact. They are hatched a little after the foliation in the spring. The young ones

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* Description. The thorax and wings are somewhat of a buff-colour. The upper wings have two ferruginous streaks.—The *caterpillars* are glaucous, with a white line down the back, and three red ones on the sides.

Synonyms. Phalæna (bombyx) neustria. *Linn.*—Bombyx neustrius. *Haworth.*—La Livrée. *Cuvier.*

do not separate, but live in one society, and form for themselves one common web, which they enlarge from time to time, as their necessities require.

These caterpillars are amongst the greatest pests to which our fruit-trees are subject. They are sometimes quite defoliated by them, and covered over with their noisome webs, contracting thereby a sickly and unpleasant appearance. The best mode of destroying them is stated to be by shaking the branches violently either with the hand, or a pole with a hook to it. This brings them quickly to the ground, where they may be easily exterminated.

As soon as the Caterpillar has attained its full growth, towards the end of the spring, it spins, between two leaves, a nidus of whitish silk, of an elongated form, and covered with a yellowish kind of powder. Within this it changes to a chrysalid, and, about twenty days afterwards, to a perfect Moth.

THE CLOTHES MOTH *.

The larva of this little Moth is well known from the damage it commits in woollen cloth and furs. These substances constitute the principal support of the caterpillar, and therefore the parent is, by its natural instinct, directed to deposit its eggs in them. The caterpillar, as soon as it quits the egg, begins to form for itself a nest: for this purpose, after having spun a fine coating of silk immediately around its body, it cuts the filaments of the wool or fur close by the thread of the cloth, or by the skin, with its teeth, which act in the manner of scissars, into convenient lengths, and applies the bits, one by one, with great dex-

* SYNONYMS. Phalæna (tinea) sarcitella. *Linn.*—Tinea sarcitella. *Fabricius. Haworth.*—La Teigne fripière. *Tigny.*

terity to the outside of its case, to which it fastens them by means of its silk. Its covering being thus formed, it never quits it but in the most urgent necessity. When it wants to feed, it puts out its head at either end of its case, as best suits its conveniency. When it wishes to change its place, it puts out its head, and its six fore-legs, by means of which it moves forward, taking care first to fix its hind legs into the inside of the case, so as to drag it along.

It lives in this manner until, by the augmentation of its size, its case becomes too small for the body. When this is felt, it begins by making a small addition to one end; then, turning itself within the case, which is always wide enough in the middle for that purpose, it makes a little addition to the other end, so as still to preserve the widest part exactly in the middle; and in the same manner it makes every successive addition.

The progress of its operations may be easily remarked, by transferring it from cloth of one colour to that of another. In this case every fresh addition will become conspicuous, by forming a small ring of the respective colours at each end as they are used.

When the case wants widening, the insect, with its scissar-like teeth, begins by making a slit lengthways, from the centre to one of the extremities. This opening it instantly fills up with a thin stripe of wool externally, and silk internally, in the same manner as the other parts. It afterwards, at a little distance from this, makes another slit at the same end, which it also fills up; then, turning itself within, it repeats the same process from the centre to the other end.

After changing within its case into a chrysalis, in about three weeks it issues a small winged nocturnal Moth, of a silvery-gray colour, well known to almost every mistress of a family.

It may be found useful to point out the best modes of preventing the havock which these insects commit in our wardrobes and furniture.—The smell of oil of turpentine is instantaneous death to them: if, therefore, the goods affected by them be put into a close place, along with a saucer or other open vessel containing oil of turpentine, the warm air raising the vapour will immediately destroy them. Sometimes, if the caterpillars be old and strong, it may be necessary to brush the clothes with a brush, the points of which have been dipped in the turpentine. The smoke of tobacco also kills them; and cloth that has been steeped in a decoction of tobacco-leaves will never afterwards be affected by them.

THE SERATELLA MOTH *.

In the month of May the leaves of the pear, and sometimes of the apple and plum-trees, may be remarked to have upon them several small, downy, and fawn-coloured cylinders, which are of a substance apparently very different from that of the leaf. The base of each cylinder is formed into a small protuberance, on which it is capable of being moved backward and forward on the leaf, without destroying its adherence.

If the cylinder be gently compressed with the fingers, a small yellowish caterpillar, with a black head, will be ob-

* Description. This is a small nocturnal Moth, of a brownish colour, marked with numerous black dots and stripes on the upper wings, which are beautifully fringed in the middle. The under wings are very small, and fringed at the margin. The hind legs are nearly twice the length of the body, and fringed at their articulations.

Synonym. Phalæna (tinea) seratella. *Linn.*

served to protrude itself, and may be entirely disengaged from its nidus by means of a fine needle. The habitation or cylinder of this caterpillar is composed of a kind of woolly substance, which the little creature spins out of its own mouth. At the first hatching of the caterpillar, this habitation is small; but as soon as it becomes too confined, the animal divides it lengthwise, by means of its jaws, and closes up the cleft with new materials. The insect, when stretched to its full length, is much longer than its cell; but it is easily able to accommodate itself to this, as it has the power of contracting itself to nearly half its greatest length.

Whenever the caterpillar is desirous of changing its situation, it gnaws asunder the few threads which secure it by the protuberance at the base of its cell, and then crawls (with the cell adhering to the hinder part of its body) to another part of the leaf, and there forms a new attachment. By this means the protuberance continually receives additions of new substance.

In feeding, the caterpillar brings down its head to the leaf, and it devours so much of the external rind as lies within the circumference of a circle formed by its own body and cell as a radius. When the produce of this little area is consumed, it gnaws through the cords of its tent, and pursues its journey to a fresh spot. Here again it fixes itself until a necessity for further removal occurs.

After having made three or four of these migrations, the little animal is prepared for its change. At what period it undergoes its first change has not been exactly ascertained, but it is probably about fourteen days after the caterpillar is hatched. It becomes a chrysalis before it quits its cell, and probably continues in this state about ten days.

If, in the months of May or June, we beat a gooseberry bush, swarms of these Moths issue forth. Their flight, in the day-time, is by jerks; and they do not fly far at a time,

but seek to conceal themselves amongst the leaves of the nearest bush.

The females do not deposit their eggs in clusters, like most other insects, but singly; and they seldom deposit more than one upon the same leaf.

So small are these insects, that they appear to have eluded the observation of most naturalists in this country; yet their numbers are sometimes such, that they commit great devastation in our orchards. The effect has been long felt, though the cause was unknown, and consequently no remedy applied. In some years the leaves of pear-trees have been so infected with these animals, that they have all fallen off, and have left the trees nearly as naked as at Christmas, so that no fruit of any kind could be obtained from them.

As the Moths are very inactive in the day, Dr. Anderson, in his Recreations in Agriculture, recommends, about the time when they become perfected, to squirt water upon the trees by means of a garden engine; thus to beat them down, and then either to bury them in the ground, or carefully to pick them up and destroy them. The operation should be repeated every morning, as long as one of them can be discovered. By taking them thus, they will not have time to deposit their eggs; so that, at all events, their numbers will be greatly reduced; and, if continued with perseverance, they will in the end be completely exterminated.

Neuropterous Insects*.

OF THE LIBELLULÆ OR DRAGON-FLIES†.

There are few of the insect tribes more beautiful than these. Their colours are various and brilliant: we observe in them green, blue, crimson, scarlet, and white; and even in some individuals, most, if not all, of these colours are united. In addition to the beauty of their colours, the brilliancy of their eyes, and the delicate texture and wide expansion of their wings, are highly deserving of notice and admiration.

They are an extremely ravenous tribe, eagerly seizing and devouring all kinds of their fellow insects. From their cloven tail the common people of many parts of England entertain a notion that they are furnished with a sting; hence they are oftentimes known by the name of *Horse-stingers*. This notion is, however, entirely erroneous.

The parent insects deposit their eggs on the surface of the water. From thence they sink to the bottom, where,

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* The Insects of the Linnæan order *Neuroptera* have four membranaceous, transparent, naked wings, in which the membranes cross each other so as to appear like net-work. The tail has no sting, but, in many of the individuals, is furnished with appendices like pincers, by which the males are distinguished.

† The mouth of the Dragon-fly is armed with jaws, generally more than two in number. The antennæ are very thin, of equal thickness throughout, and shorter than the thorax. The wings are expanded, and the tail of the male insect is furnished with a forked process.

in due time, they are hatched. The *larvæ*, which proceed from these eggs, are active inhabitants of the water; and, furnished with forcipated jaws, they prey with the most rapacious ferocity on aquatic insects. The *chrysalis* resembles the larva in every respect except in having the rudiments of wings.

In both these primary states the animals respire water by receiving and ejecting it at an aperture at the termination of their bodies. They are occasionally observed to throw out water from thence with such force, that the stream is perceptible to the distance of two or three inches from their bodies. If they be kept some time out of water, the desire or necessity of respiration is augmented: and accordingly, when replaced in a vessel filled with water, inspirations and respirations are repeated with unusual force and frequency. If one of them is held in the hand, and drops of water are applied to the posterior end of its body, it instantly, by an apparatus somewhat similar to the piston of a pump, sucks in the water, and the dimensions of its body are visibly augmented. This water is again quickly thrown out by the same instrument. But though this insect thus respires the water, air seems to be not the less necessary to its existence: for, like other insects, the whole interior part of the body is amply provided with large and convoluted breathing-pipes; and, externally, there are several small openings destined for the introduction of air.

THE GREAT DRAGON-FLY*.

This, in its perfect state, is one of the most brilliant of the British species, and affords a singular instance of the

* DESCRIPTION. The length of this insect is about four inches, and it is of proportionate thickness. The eyes are blue and large.

wonderful diversity of form and manners between the larva and complete states of the same animal.

The parent insect, towards the end of May, when ready to deposit her eggs, seeks the warm and sheltered sides of ponds or ditches. She drops them on the surface, hovering at the same time up and down just above. The eggs immediately sink to the bottom, and, after a little while, are hatched into larvæ of a dirty brown colour with six legs, and bearing no resemblance whatever to the parent. These are excessively voracious, and destroy with their forcipated jaws multitudes of small water insects. This formidable apparatus is so constructed as to fold over the face when at rest, and to be suddenly thrown forwards, when in action, to a considerable extent. The chrysalis differs from the larva only in exhibiting the rudiments of future wings, which are enveloped in short cases or processes on the back of the animal. After remaining in this state about two years, the animal ascends the stem of some water-plant, and, sitting some time in the sun-shine, gives life to the insect in its perfect or ultimate form. This generally so disengages itself from the skin of the chrysalis, that it leaves it in exactly its former appearance on the stem. "About the beginning of May," says Mr. Bartram, in the Philosophical Transactions, "I observed many deformed water insects, called *Hexapodes*, creep out of the water and fix on shrubs and rushes. In this situation they continued but a few hours before their backs split open, and from the deformed creatures sprung out beautiful flies

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The thorax is variegated with green, yellow, and black; and the abdomen generally with blue and black; but the colours vary considerably.

SYNONYMS. Libellula grandis. *Linn.*—Æshna grandis. *Fabricius.*—La Libellule grande. *Tigny.*—Great Libellula. Variegated Libellula.

with bright shining wings, all of which, in less than an hour afterwards, attained their complete dimensions." At the first exclusion of the insect, the wings are weak and tender, and folded into a very narrow compass. During their unfolding, and till they become perfectly dry, it continues almost motionless; but they are no sooner completed, than the little animal commences an inhabitant of the air, and would now be as effectually destroyed by continual submersion under water, as the larva would before have been by exposure to the air.

In their complete state, the Dragon-flies, as I have already remarked, feed on the smaller insects; and they are also remarkable for the vigour and celerity of their flight. The Rev. Revett Sheppard informs me, that in the summer of 1801, he sat for some time by the side of a pond, to observe a large Dragon-fly as it was hawking backwards and forwards in search of prey, 'when suddenly a large white butterfly, *Papilio Brassicæ*, flew past. The Dragon-fly instantly attacked and caught it in the air, then settled on a twig, close at hand, to eat it at leisure. It bit off all the wings, and then, in less than a minute, devoured the whole body.

These insects, which are very common in England, delight in sunshine, and are seldom to be seen abroad in cloudy weather, hiding themselves, during the absence of the sun, under the leaves and branches of trees.

OF THE EPHEMERÆ, OR DAY-FLIES.*

The Ephemeræ differ in many respects from all other insects. Their *larvæ* live in water (where earth and clay

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* The mouth of the Ephemera has no jaws, but is furnished with four very short thread-shaped feelers. The antennæ are short and

seem to be their only nourishment) for three years, the time they consume in preparing for their change, which is performed in a few moments. The larva, when ready to quit that state, arises to the surface of the water, and, getting instantaneously rid of its skin, becomes a chrysalis. This *chrysalis* is furnished with wings, which it makes use of to fly to the nearest tree or wall; and there settling, it in the same moment quits a second skin, and becomes a perfect Ephemera. In this state all the species live but a very short time, some of them scarcely half an hour, having no other business to perform than that of continuing the race. They are called the insects of a day; but very few of them ever see the light of the sun; being produced after sunset, during the short nights of summer, and dying long before the dawn. All their enjoyments, therefore, seem confined entirely to their larva state.

The Ephemeræ are very frequent near waters, and in some places multiply enormously. About Laz, in Carniola, a province in Germany, we are informed by Scopoli, that they are so numerous in the month of June, that they are used as manure, and if each farmer cannot obtain more than *twenty cart loads*, the harvest is considered a bad one.

The larvæ scoop out dwellings in the banks of rivers, which consist of small tubes, made like syphons, with two holes, the one serving for an entrance, and the other as an outlet; and these are so numerous, that the banks of some rivers are observed to be full of them. When the waters decrease, they dig fresh holes lower down. The flies are produced nearly all at the same instant, in such numbers, as even to darken the air.

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thread-shaped; and above the eyes there are two or three large stemmata The wings are erect, (the lower ones much the shortest,) and the tail is terminated by long hairs or bristles.

The females, by the help of the threads of their tails, and the flapping of their wings, support themselves on the surface of the water, and, in an almost upright position, drop their eggs in little clusters into the water. A single insect will lay sometimes seven or eight hundred.

THE COMMON EPHEMERA, OR DAY-FLY*.

M. de Reaumur has described very accurately the metamorphosis of one species, which, except in the time of the year when it is produced, and the duration of its fly state, seems much to resemble the present species, and is, most probably, only a variety of it.

On the nineteenth of August, 1738, he waited for some time after sun-set on the bank of the Seine, to see, as he had been informed he might, millions of Ephemeræ come out of the water, and rise into the air, and was returning disappointed along with his servants, who were carrying a tub containing several lumps of earth full of their holes and nymphæ, when scarcely had it been set on one of the steps of the stairs, than those who had the charge of it exclaimed, "What a vast quantity of Ephemeræ are here!" M. de Reaumur seized one of the lights, and ran to the tub. Every part of the earth that was above the water, was covered with Ephemeræ, some of which had just begun to put off their coverings, others had almost effected it, and others entirely completed it, and were about to take wing. A storm of lightning and rain, which had been some time coming on, now drove him into the house; but, to prevent the Ephemeræ from flying

* DESCRIPTION. The tail has three filaments. The wings are brown and white.

SYNONYMS. Ephemera vulgata. *Linn.*—L'Ephémère commune, in France.

away entirely in his absence, he had the precaution to cover the tub with a cloth. The violence of the rain continued for about half an hour, and on its ceasing he returned to the garden. On taking off the covering he found the number of Ephemeræ very considerably augmented, and they continued to multiply for some time as he stood watching them. The number already transformed from the earth that they had conveyed from the river, would have been sufficient to have filled the tub; but this number was prodigiously augmented by the accession of strangers, which were attracted by the light from all quarters. He again spread the cloth over the tub, and the light was held above it: immediately the cloth was almost concealed by the vast multitudes which alighted upon it. But what he had seen about the tub, was nothing to what he saw when he went again to the side of the river. "The quantity of Ephemeræ," says he, "which filled the air, can neither be expressed nor conceived. When snow falls thickest, and in the largest flakes, the air is never so completely filled with them, as that which surrounded us was with Ephemeræ. Scarcely had I remained a few minutes in one place, when the step on which I stood was covered in every part with their bodies, to the depth of two or three, and in some places even of more than four inches. The whole surface of the water, for at least six feet from the bank, was entirely covered with a coat of Ephemeræ; those which the current carried off were more than replaced by those which fell continually in that place. I was several times compelled to abandon my station, by retreating to the top of the stair, not being able to sustain the shower of Ephemeræ, which, not falling so perpendicularly as an ordinary shower, or with an obliquity equally constant, struck me uninterruptedly, and, in a very troublesome manner, on all parts of the face: my eyes, nose, and mouth, were

filled with them. It was an unpleasant post to hold the candle on this occasion; the man who held it had his whole body covered with these flies in an instant; they rushed to him from all parts in such quantities, as to oppress him. The light of the candle occasioned a spectacle altogether different from any thing that can be observed in any kind of meteorological shower: it was indeed enchanting. The most unobserving of my domestics could scarcely ever have been tired of admiring it. No astronomic sphere was ever formed so complicated as it was, nor was furnished with so many circular zones in every possible direction, having the flame of the candle for their common centre. Their number appeared to be infinite, having all possible degrees of obliquity with respect to each other. Each zone was formed by an uninterrupted string of Ephemeræ, which, as if tied together, followed each other close in the same line; they seemed to form a circular ribbon of silver, deeply indented on its edges; a ribbon formed of equal triangles put end to end, so that the angles of those that followed, were supported by the base of that which preceded, the whole moving round with great quickness. Ephemeræ, whose wings only were then distinguishable, and which circulated around the light, formed this appearance. Each of these flies, after having described one or two orbits, fell to the earth, or into the water, but without having been burned by the candle." At the end of about half an hour from its commencement, the great shower began to abate, and in little more than an hour, scarcely any Ephemeræ could be seen above the river, and no more came near the candle. This phenomenon M. de Reaumur found, upon examination, took place every evening, commencing usually about the same hour, during most of the summer months.

In this short period of existence, the female appears to

have no other business than to lay her eggs. These are contained in two large packets, each enclosing from 300 to 400. They are both extruded from the body at the same time, through two openings formed for the purpose, and they fall together in one accumulated mass, upon the water. To enable the creature to extrude these, and at the same time to fill up the great vacuum in the abdomen, that must instantaneously take place, the fly is provided with a couple of small bladders, which it has the power of filling with air.

The singular quickness and ease with which these little creatures strip themselves of the slough of the nymph, in order to become flies, is very surprising. We do not draw our arm more quickly from the sleeve of a coat, than the Ephemera draws its body, its wings, its legs, and the long filaments of its tail, from that complicated vestment which forms a kind of sheath for all these parts. No sooner is a rent effected in the corselet, and the body seen through that rent, than the rest of the operation is finished in an instant. Sometimes, indeed, it happens, that the filaments of the tail cannot be so quickly disengaged as the rest of the body. In this case, the insects fly away with their slough appended: and sometimes also these slender filaments are broken off.

OF THE PHRYGANÆ, OR CADEW FLIES.*

The Phryganeæ are to be observed, during the spring and summer months, flying about, or resting upon the grass and weeds near the borders of rivers, streams, and

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* The mouth is furnished with a horny, short, curved mandible, and four feelers. The antennæ are setaceous, and longer than the thorax. The wings are equal, incumbent; and the lower ones folded.

ponds. They deposit their eggs on aquatic plants. These are enclosed in a glairy matter, as transparent as water, and of the consistence of jelly, by means of which they firmly adhere to the place where they have been deposited.

The larvæ, when hatched, form for themselves tubes of silk, the interior of which is smooth and polished, and to the exterior of which they attach fragments of different substances, thus constituting a strong defence against the attempts of their enemies. Some of the species employ, for this purpose, bits of leaves, straw, grass, or rushes; others adopt the shells of small aquatic snails; others, grains of sand; and others, employ several different kinds mixed together. They contrive to make their habitations nearly in equilibrium with the water, by adding a bit of wood when too heavy, and some heavier substance when too light.

The *larvæ* have each six scaly legs; and their body is composed of twelve annules. The legs are attached to the three first rings, and the fourth has three fleshy eminences, by which Reaumur is of opinion, they respire and reject water. They feed on the larvæ of other water insects, and also on the leaves of aquatic plants.

THE GREAT CADEW FLY *.

The larvæ of the Great Cadew Flies, form a case with small bits of wood disposed longitudinally. In the interior of this they reside, and undergo their change into a *pupa* state. As in the other species, their tube is exactly cylindrical, having an opening at each end.

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* DESCRIPTION. The wings are of a testaceous brown colour, with cinereous spots.

SYNONYMS. Phryganea grandis. *Linn.*—La grande Frigane. *Cuvier.*

They are unable to swim; but can crawl nimbly about at the bottom of the water, or up the stalks and upon the leaves of aquatic plants, on which they feed. In the act of crawling they push out of the case their head and legs, dragging at the same time, like the snail, their habitation along with them.

Like the larvæ of other Cadew Flies, they undergo their change to the pupa state, under the protection of their case; closing for this purpose both the apertures. This is done with a kind of silk, which they spin from their bodies, and which forms a kind of net-work of sufficient strength to defend them from the attacks of their foes, and yet with meshes sufficiently wide to admit of the free passage of water for the respiration of the *pupa*.

After a lapse of fifteen or twenty days from the time of the larva having closed up its case, the *pupa* becomes so far perfected, as to abandon it. It now crawls by means of its four anterior feet, which, like the others, are enclosed in a kind of envelope, up the side of the bank, or up the stem of some aquatic plant, to the surface of the water. Here it searches out a dry place, where it can rest for a little while in tranquillity, until, by the warmth of the atmosphere, its skin becomes perfectly dry. This then splits open, and, in a few minutes, the perfect insect issues forth, and, after its wings are hardened, flies away.

*OF THE MYRMELEON OR ANT-EATER TRIBE**.

The Myrmeleons constitute a tribe of insects which are highly interesting from their extremely singular habits of life in a larva state.

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* The antennæ of these insects are about the length of the thorax, and thickest at the tip. The mouth is armed with jaws, teeth, and six feelers. The wings are deflected; and the abdomen of the male terminates in a forceps composed of two straight filaments.

The *larvæ* are hairy, with six feet, and strong, exserted, and toothed jaws. They prey with most savage ferocity on ants, and some of the other smaller insects; and, for the purpose of ensnaring the prey, form a kind of funnel or pit in light earth, at the bottom of which they lie buried. The manners of most of the tribe greatly resemble those of the following species.

The *chrysalis* is enclosed in a little ball of sand or earth, the particles of which are agglutinated together by a viscid matter, which the larva mixes with it previously to its change.

THE COMMON MYRMELEON, OR ANT-LION *.

The name of this insect has been obtained from the circumstance of its larva subsisting principally on ants. This food it is able to obtain only by stratagem.

The usual situation which the larva adopts for its residence is in a dry, sandy soil, under some old wall or other protection from the wind. Here he forms a pit of the shape of a funnel. If this is only to be small, he thrusts himself backward pretty deep, and artfully throws out the loose sand, which has fallen in upon him, beyond the edges of the hollow, and at the bottom he then lies con-

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* Description. In its perfect state, this insect somewhat resembles in shape the dragon-fly. It is of a dark or blackish gray, with some spots on its thorax and the posterior border of the rings of its abdomen. The wings have some spots of blackish brown.

The *larva*, in its general appearance, is not much unlike a spider. Its body is of a dirty gray colour, marked with black spots. The head is small and flat, and from this proceed two horns, each about the sixth of an inch long, hard, hollow, and hooked at the end.

Synonyms. Myrmeleon formicarius. *Linn.*—Le Myrméléon des Fourmis. *Tigny.*

cealed. If it is to be of greater extent, he begins by first tracing in the surface of the sand a tolerably large circle, which is to form its base. He then gets under the sand near the edge, and proceeding backward in a spiral direction, carefully throws up all the particles that fall upon his body beyond the circumference of the circle: this he continues until he arrives at the apex of the cone he has thus formed. His long neck, and flat head, he uses as a spade; and the strength of these parts is so great, that he is able to throw off at once a considerable quantity of sand to even six inches distance.

His pit being finished, he buries himself among the sand at the bottom, leaving only his horns visible. Here he patiently waits for his prey. When an ant or any other small insect happens to walk over the edges of the hollow, its steps force down some of the particles; which gives the Ant-lion notice of its presence. He immediately throws up the sand which covers his head, to overwhelm the ant, and, with its returning force, bring it to the bottom. This he continues to do till the insect is overcome, and falls between his horns. Every endeavour to escape, when once the incautious ant has stepped within the verge of the pit, is vain; for, in all its attempts to climb the side, the deceptious sand slips from under its feet, and every struggle precipitates it still lower. When within reach, its enemy plunges the points of his jaws into its body, and having sucked out all its juices, throws out the empty skin to some distance, that the den may not become frightful to others by seeing their fellow carcasses strewed about. This done, the insect mounts the edges of his pit, and repairs whatever injury it may have sustained; and then, descending, again conceals himself at the bottom.

The jaws of this creature are hollow, and serve as pumps to draw into its stomach the juices of those insects on

which it feeds; for in the head there is no mouth, nor any other organ which can answer the same purpose. The horns being therefore so necessary to its life, nature has provided for the restoring of them in case of accident; for, if cut off, they are found to grow again.

The food this creature procures by its pit, can be but little; and as it has no power of catching its prey by any other mode, its motions being very slow, some persons have believed that its catching now and then an ant by this means, was rather an act of diversion than hunger. But though the Ant-lion will live a long time without food, and even pass through all its changes when shut up in a box, yet it is always ready to eat when food is offered to it. It always appears starved and small when kept thus; and if a fly be given to it in that hungry state, it will suck out all its juices so perfectly, that the remaining shell may be rubbed to powder between the fingers, whilst the body of the creature that has sucked it, appears remarkably swelled and distended. For the sake of experiment, M. Poupart put one of them into a wooden box with some sand, and covered it with a glass, so as to exclude every other insect. Here it formed its cone, and watched as usual for prey, though in vain. Thus he kept it for several months, while in an adjoining box he kept another of the same species, which he supplied with food, by giving it ants and flies pretty regularly. He could perceive no difference between the movements or actions of the two; but when he took them from their holes, he found the abdomen of that which had received no food, was shrunk to a very diminutive size, whilst the other retained its proper shape.

When the Ant-lion has lived its usual time in the larva state, it leaves its pit, and buries itself under the surface of the sand. Here it encloses itself in a fine web, in which

it is to pass its tranformation into a winged state. This web is made of a sort of silk, which the creature spins in the manner of the spider, and of a quantity of the grains of sand cemented together by a glutinous humour which flows from its pores. This case, however, would be too harsh and coarse for the body of the creature, and therefore it serves only for the covering, to defend it from external injuries; the animal spinning one of pure and incomparably fine silk, of a beautiful pearl colour, within it, which covers its whole body.

When it has lain some time in this case, it throws off its outer skin, and becomes an oblong nymph or chrysalis, in which a careful eye may trace the form of the fly into which it is to be transformed. This nymph makes its way about half out of the shell, and remains in this condition, but without further life or motion, until the perfect fly comes out at a slit in the back.

When this insect forms its pit in a bed of pure sand, its habitation is made and repaired with great ease; but, where it meets with other substances among the sand, the labour becomes much more embarassing. If, for instance, when the creature has half formed it, it comes to a stone of some moderate size, it does not desert the work on this account, but goes on, intending to remove that impediment the last. When the pit is finished, it crawls backward up the side of the place where the stone is; and, getting its tail under it, takes great pains and time to get it on a true poise, and then begins to crawl backward with it up the edge to the top of the pit, to get it out of the way. It is a common thing to see the Ant-lion labouring in this manner at a stone four times as big as its own body; and as it can only move backward, and the poise is difficult to keep, especially up a slope of such crumbling matter as sand, which moulders away from under its feet, and necessarily alters the position of its body, the stone very frequently

rolls down, when near the verge, quite to the bottom. In this case the animal attacks it again in the same way, and is often not discouraged by five or six miscarriages; but continues its struggles so long, that it at length gets it over the verge of the place. When it has done this, it does not leave it there, lest it should roll in again; but is always at the pains of pushing it further on, till it has removed it to a necessary distance from the edge of the pit.

The insect, in a perfect state, is but seldom found; it is, however, sometimes to be met with in sandy places, and near rivulets. It is marked in Dr. Turton's Translation of the *Systema Naturæ*, as a native of this country, but I have never yet heard of any one's discovering it within our island.

Hymenopterous Insects*.

OF THE CYNIPS OR GALL-INSECT TRIBE†.

The greater part of the species of Gall-insects are produced from eggs deposited by the parent insects in the tender branches, or upon the leaves, of trees, in the spring of the year; others live concealed among the leaves, and others are bred in the bodies of other insects.

The Gall-insects which deposit their eggs in the branches or leaves of trees, place them in a small hollow which they form by means of an instrument at the posterior part of their body. Each egg is fixed to the spot by a kind of gluey matter with which it is covered.

The juices of the leaf or stem overflow by the small vessels which are opened in this operation, and thus form a gall or excrescence, in which the egg becomes enclosed. When the larva is hatched, it finds around it the food that is necessary for its subsistence. It gnaws and lives upon the substance of the gall, which increases in bulk and consistence, in proportion as its interior is thus destroyed.

Some of these galls have, in their interior, either only one cavity in which many larvæ are enclosed together, or

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* The Insects of the Linnæan order *Hymenoptera* have generally four membranaceous, naked wings. In some of the tribes the neuters, and in others, the males or females, are destitute of wings. The tail, in the females and neuters, is armed with a sting.

† The mouth is furnished with a short, single-toothed, membranaceous jaw. The mandibles are horny, cleft, and the lip is entire. The feelers are four in number. The sting is spiral, and often concealed within the body.

many small cavities, having a communication with each other; some have many separate cavities; and others have only one cavity, which is occupied by a solitary insect.

When the larvæ have attained their full growth, some of the species eat their way out, and drop upon the earth, in which they bury themselves, and there undergo their metamorphoses; and others are transformed within the galls, and leave them only as perfect insects.

THE GALL-INSECT OF THE GROUND IVY *.

These insects sometimes deposit their eggs on the stems, but most commonly on the leaves, of the ground ivy. The galls produced are, in general, smaller than those of the oak, though they are sometimes seen as large as a small nut. Their interior is soft and spongy; and on the exterior there are several fibres or small fleshy scales. Towards the centre the galls are hard and ligneous. Each gall contains in its centre a single larva.

THE OAK-BUD † AND OAK-LEAF GALL-INSECT ‡.

The eggs of the former of these insects are deposited in the buds of the oak. Here they produce a beautiful

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* DESCRIPTION. This insect is of a blackish brown colour, with the thorax somewhat downy.

SYNONYMS. Cynips glechomatis. *Linn.*—Le Cinips du Lierre terrestre. *Tigny.*

† DESCRIPTION. The length of this insect is about a line. Its body is of a golden green. The antennæ and legs are yellowish.

SYNONYMS. Cynips quercus-gemmæ. *Linn.*—Le Cinips rosacé. *Tigny.*

‡ DESCRIPTION. The antennæ are pale yellow. The thorax and abdomen are golden green; and the legs pale.

SYNONYMS. Cynips quercus-folii. *Linn.*—Le Cynips des Feuilles. *Tigny.*

imbricated gall, in appearance not altogether unlike a rose-bud when beginning to blow. In the centre of this there is a ligneous kernel, in the middle of which again is a cavity that contains the larva. The little creature there feeds, grows, and undergoes its metamorphoses. The whole gall is oftentimes nearly an inch in diameter, and it is connected to the branch by a short pedicle or foot-stalk.

On the under sides of the leaves of the oak there are, in the summer time, frequently to be seen several small spherical galls. These are formed around the larvæ of the latter of the above-mentioned insects. They are generally fastened to the fibres of the leaf, and each contain a single insect. The cavity is large, and the gall is ligneous in the interior. Its parietes are generally about twice the thickness of an oak-leaf.

OF THE TENTHREDO OR *SAW-FLY TRIBE**.

By means of the saw with which these insects are supplied, some of the species deposit their eggs in the buds of flowers, and others in the twigs of trees or shrubs. This implement, which is situated in the posterior part of their body, is formidable only in appearance, and appears destined solely to the purpose of depositing their eggs.

The larvæ have from eighteen to twenty-eight legs. They subsist upon the leaves of plants; and, when full grown, some of them bury themselves in the ground, and others form a nidus between the leaves of the plant on which they feed, and within it change to a *pupa*. Those which

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* The mouth has a horny curved mandible, toothed within. The jaw is straight and obtuse at the tip, and the lip is cylindrical and bifid. The feelers are four in number, and filiform. The wings are tumid, the lower ones shorter. The sting is composed of two serrated laminæ, and is almost concealed in the body.

undergo their change under the earth usually remain there during the winter, the perfect insect issuing forth in the ensuing spring.

THE SAW-FLY OF THE GOOSEBERRY-TREE *.

This species of Saw-fly breeds twice in the year. The larvæ may be first discovered, says Dr. Anderson, by the appearance of a few small holes in the leaves of the gooseberry trees. Where two, three, or more such holes are remarked in a leaf, without any kind of discolouring, on examining the under part it will generally be found that a few of the caterpillars only have been hatched, and have each begun to eat. But the creatures are now so small, and so much of the same colour as the leaf, that this must be examined with considerable attention before they can be perceived. The greatest part of the brood continue still in the eggs, which may be found adhering to the larger ribs of the leaf in regular rows, of an oblong shape, and appearing like little white specks.

From this regular disposition of the eggs upon the leaf, it is evident that they must have been deposited there by the parent fly, after the leaf has been formed. Not long after the eggs are hatched, the little animals eat so voraciously, that their holes will be found run one into another, and the whole soft part of the leaf eaten out, leaving only the fibres untouched. As many as a hundred and fifty of these caterpillars have been counted on a single leaf, the half of which, if suffered to go on undisturbed until their full growth, would alone devour all the leaves of a large

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* Description. This insect, says Dr. Anderson, is small, of a yellowish tinge, and, in its general appearance, is not much unlike a common house-fly. *Anderson's Recreations in Agriculture.*

Synonym. Tenthredo grossulariæ.

bush. So that by plucking off this single leaf at a proper time, not only those of the whole bush may be saved, but, at the same time, the future ravages of those that would spring from them would be prevented.

When the insects are about to enter their chrysalid state, they conceal themselves in the earth. Here they undergo that change, and after a short time become perfected. This usually happens about the month of July. These insects now deposit their eggs, and die.

At this season of the year the eggs are very soon hatched, and the young caterpillars issue forth in swarms, and destroy the leaves in the autumn. Many of them perish from the leaves falling before they arrive at maturity. Such, however, as enter the chrysalid state previously to this defect of food, pass the winter in this state, and are changed into flies early in the spring.

The flies are of a sluggish disposition, often remaining stationary on the leaves for several minutes together, and not being easily disturbed. This sluggishness renders them an easy prey to birds, by whom they are eagerly devoured.

*OF THE ICHNEUMONS IN GENERAL**.

All the Ichneumons are parasitical; their larvæ deriving support from other insects. The female, when about to lay her eggs, perforates with her sting either the body or the nidus of some other insect or caterpillar, and deposits

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* The antennæ of the Ichneumon flies taper towards their extremity, and consist of more than thirty joints or articulations. The mouth is armed with jaws, and has four unequal, thread-shaped feelers. At the extremity of the abdomen there is a long sting, having, however, no pungent property, enclosed in a cylindrical sheath composed of two valves.

them there. The sting of *one* of the species, though extremely fine, is so strong as to penetrate through mortar and plaster. The food of the family to be produced from the eggs of this fly is the larvæ of wasps or mason-bees; for it no sooner discovers one of those nests than it fixes on it, and in a moment bores through the mortar of which it is built.

Some species agglutinate their eggs upon caterpillars; others penetrate their bodies, and deposit the eggs in their inside. When the *larvæ* are hatched, the head is so situated that they pierce the caterpillars, and penetrate to their very entrails. These larvæ suck the nutritious juices of the creatures without attacking their vitals; for they seem to be all the time perfectly healthy, and even sometimes are enabled to transform themselves into chrysalids. "A friend of mine," says Dr. Derham, "put about forty large caterpillars, collected from cabbages, on some bran and a few leaves, into a box, and covered it with gauze to prevent escape. After a few days we saw, from more than three fourths of them, about eight or ten little caterpillars of the Ichneumon fly come out of their backs, and spin each a small coccoon of silk, and in a few days the large caterpillars died."—The Ichneumons performed singular service, in the years 1731 and 1732, by multiplying in the same proportion as the caterpillars: their larvæ destroyed infinitely more of these voracious creatures than could possibly have been done by all the efforts of human industry.—Aphides or Plant-lice, and the larvæ of various other insects, are also made the nidus of the Ichneumon.

ICHNEUMON MANIFESTATOR *.

The care and attention paid by the whole of the animal creation to the preservation of their offspring, is a subject

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* DESCRIPTION. The present species is about an inch in length from the head to the extremity of the abdomen: the tail measures

that has employed the attention and excited the admiration of all ages; yet there are few creatures in which these properties are more manifest than in this diminutive animal.

Thomas Marsham, Esq. an accurate observer of nature, seems to have been the first who has recorded this part of the economy of the Ichneumon Manifestator. In the month of June, 1787, he observed one of these insects on the top of a post in Kensington Gardens. It moved rapidly along, having its antennæ bent in the form of an arch; and, with a strong vibratory motion in them, felt about until it came to a hole made by some insect, into which it thrust them quite to the head. It remained about a minute in this situation, apparently very busy, and then, drawing its antennæ out, came round to the opposite side of the hole, and again thrust them in, and remained nearly the same time. It next proceeded to one side of the hole, and repeated the same operation there. Having now again drawn out its antennæ, it turned about; and, dexterously measuring a proper distance, threw back its abdomen over its head and thorax, and projected the long and delicate tube at its tail into the hole. After remaining nearly two minutes in this position, it drew out the tube, turned round, and again applied its antennæ to the hole for nearly the same time as before; and then again inserted its tube. This operation was repeated three times; but Mr. Marsham approaching too near, in order, if possible, to observe with a glass what was passing in the tube, he frightened the insect entirely away.

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nearly an inch and a half, and the antennæ somewhat more than half an inch. The body is black, and the legs are dusky. The abdomen is cylindrical and sessile, not being connected with the thorax, as in several of the species, by a pedicle.

SYNONYMS. Ichneumon Manifestator. *Linn. Gmel.*—L'Ichneumon Manifestateur. *Tigny.*

About a week afterwards Mr. M. was in Kensington Gardens, and saw several of these Ichneumons at work. They seemed to pierce the solid wood with their tubes, which they forced in even to half their length, constantly passing them between the hinder thighs, which they closed in order to keep the tubes straight, when over resistance would otherwise have forced them to bend. It appeared truly surprising to see an instrument, apparently weak and slender, able, with the strength of so small an animal, to pierce solid wood half or three quarters of an inch deep; but, on particular attention, it was discovered, that all those that appeared to pierce the solid wood, did it through the centre of a small white speck, resembling mold or mildew, which, on minute examination, was found to be fine white sand, delicately closing up a hole made by the *Apis maxillosa*, and where, no doubt, there were young bees deposited.

In deep holes that were not closed, the insect not only thrust in the whole tube, but in some cases the whole of the abdomen and posterior legs, leaving out only the two fore feet and wings, which it placed in contrary directions like arms. The two cases of the tube were also projected up the back, with the ends appearing above the head out of the hole.

From Mr. Marsham's account it appears, that these insects do not adopt any hole indiscriminately as a situation for their eggs; for, in many instances, he saw them thrust their antennæ into holes and crevices from which they almost immediately withdrew them, and proceeded in search of others. As the whole of the Ichneumons deposit their eggs in the body of some other creature as a nidus, it appears probable that in these instances they found the holes empty, and that they went on in search of those in which the young of the *Apis maxillosa* were deposited.

A particular instance of sagacity in one of these little

animals is deserving of remark. While it had its tube inserted, the cases were, as usual, projected upwards out of the hole; and the wind, being very powerful, rendered it difficult for so delicate a creature to maintain its situation, as these long cases were so strongly acted upon by the wind as to endanger its being overset several times. To remedy this inconvenience, with a wonderful dexterity it brought the cases down between its legs, and projected them forwards under its body toward the head; by which means it retained its situation securely.

OF THE SPHEGES IN GENERAL.*

Many species of Sphex are common in England. They are chiefly found in woods and hedges; and their larvæ feed on dead insects, in the bodies of which the parent Spheges lay their eggs.

Some of the species dig holes in the earth, like dogs, with their fore feet, in each of which they bury an insect, after depositing their eggs in its body, and then carefully close them up again with earth.

There are no insects which display greater affection for their offspring than these; nor are any more rapacious. They are excessively fierce, and, without hesitation, attack insects much larger than themselves. Their strength is very great; their jaws are hard and sharp, and their stings armed with poison, which suddenly proves fatal to most of the creatures with which they engage. The Sphex seizes, with the greatest boldness, on the creature it attacks, giving a stroke with amazing force, then falling off to rest

* The antennæ in this tribe consist of ten joints or articulations; and the mouth is armed with jaws. The wings in both sexes are extended, and do not fold together. The sting is pungent, and concealed within the abdomen.

from the fatigue of the exertion, and to enjoy the victory. It keeps, however, a steady eye on the object it has struck until it dies, and then drags it to its nest for the use of the young. The number of insects which this creature destroys, is almost beyond conception, fifty scarcely serving for a meal: the mangled remains about the mouth of its retreat, sufficiently betray the sanguinary inhabitant. The eyes, the filament that serves as a brain, and a small part of the contents of the body, are all that the Sphex devours.

THE TURNER SAVAGE*.

This insect lives in the haunts of men, whom it never willingly offends; but it is the terror of all the smaller insects. It inhabits holes in the earth or the sides of hills and cliffs, and recesses that it forms for itself in the mud-walls of cottages and outhouses. The mud-wall of a cottage at Peterborough, in Northamptonshire, was observed to be frequented by these creatures; and, on examination, it was found to have been wrought into the appearance of honey-comb by their operations.

The eggs, as in all the other species, are deposited by the female in the back part of the cells. These cells are stored with insects, for food to the larvæs soon as they come into life, and are then filled up.

Dr. Derham observes, that a species of Savage built its nest in a little hole of his study window. The cell was coated over with an odoriferous and resinous gum, collected, as he supposed, from some neighbouring fir-trees.

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* DESCRIPTION. The body is black, and the legs and petiole which connects the abdomen and thorax, are yellow.

SYNONYMS. Sphex spirifex. *Linn.*—Le Sphex porte-épine, in France.

The insect laid two eggs, and he soon afterwards observed it several times to carry in maggots, some of which were even larger than itself. These it very sagaciously sealed up with great carefulness in the nest, and then altogether left it.

OF THE SAND-WASP TRIBE*.

The Sand-wasps were separated from the last tribe by the Rev. Mr. Kirby; though, in their manners and œconomy, the insects of each bear a near resemblance. In their external appearance there are, however, characteristics sufficient to admit, with great propriety, of two genera.

THE COMMON SAND-WASP†.

About sandy banks, exposed to the sun, in many of the English counties, this insect is very common, but it is rare in the neighbourhood of London. It is easily distinguished from other insects by the elongated pedicle of its abdomen, and very short wings. When it flies it always carries its abdomen pointing upward, so as to be nearly

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* The beak is conical, inflected, and contains a retractile, tubular tongue, that is cleft at the end. The jaws form a kind of forceps, and are three-toothed at the tip; and the antennæ in each sex are thread-shaped, with about fourteen joints or articulations. The eyes are oval, and the wings plane. The sting is pungent, and concealed in the abdomen.

† Description. In this species the antennæ have thirteen articulations, and are inserted in a hollow on the front of the head. The abdomen is club-shaped, and joined to the thorax by a long two-jointed pedicle. The wings are equal, and the colours of the body black and ferruginous alternately.

Synonyms. Sphex sabulosa. *Linn.*—Ammophila vulgaris. *Kirby in Linn. Tran.*—Le Sphex du Sable, in France.

at right angles with that part of the thorax to which it is attached.

In its manners, it is nearly allied to the species of the preceding genus. The most pleasing fact I have seen respecting it, is that related by Mr. Ray: "I observed one of them (says he) dragging a green caterpillar thrice its own size. It laid this down near the mouth of a burrow that it had made in the ground; then, removing a little ball of earth with which it had covered the orifice, it first went down itself, and, after staying a short time, returned, and, seizing the caterpillar again, drew it down also. Leaving the caterpillar there, it came up again, and, taking some little globules of earth, rolled them one by one into the burrow, scraping the dust in at intervals with its fore-feet, in the manner of a dog, thus alternately rolling in pieces of earth, and scraping in dust, till the hole was full; sometimes going down (as it seemed) in in order to press down the earth; and once or twice flying to a fir-tree which grew near, perhaps for the purpose of getting turpentine to glue it down, and make it firm. The hole being filled, and equalled with the superficies of the earth, that its entrance might not be discovered, it took two fir-leaves that were near, and laid them by the mouth, most probably to mark the place."

THE BLUE SAND-WASP *.

These little creatures form for their cells cylindrical pipes of clay, (each about the thickness and length of the little finger,) against the timber under the roofs of houses,

* DESCRIPTION. This insect is about three quarters of an inch long, and of a dark blue colour. The pedicle connecting the abdomen and thorax, is about a quarter of an inch in length. The an-

or under pales, where they are sheltered from the weather. They form eight or ten of them by the side of and joining to each other. Each of these tubes is divided by several partitions, betwixt every one of which the female lays an egg; and as they are formed, they are stopped up. But none of them are closed without an egg, and the bodies of several insects having been previously deposited there, in order to support the future young as soon as it comes to life. When one tube is stopped up, another is begun at its end, and so on till the whole work is completed. These insects are silent at all times, except during the plastering and forming of their cells; and they no sooner set about their work, than they always emit an odd, but pleasing sound, which is audible at the distance of ten or twelve yards, and seems to render their labour cheerful. It is exceedingly diverting to observe the surprising dexterity and the whimsical gesticulations which they adopt in performing this important business. They first moisten the clay, then temper it into a little lump of the size and shape of a swan-shot, and apply it to the walls of their nest. They commence their operation at the upper part, and work downward, till the cell is long enough to contain the chrysalis.—After having spread out this little lump in a proper manner, they return for fresh materials. They cease their humming noise the moment they depart from their cell, but always commence it immediately on putting together the materials they have been out for. When a cell is finished, they are always careful to render it perfectly smooth on the inside.

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tennæ are black, and the wings tinted with blue, and tipped with black.

It is found in Carolina, and various other parts of North America.

SYNONYMS. Sphex cyanea. *Linn.*—Vespa Ichneumon cærulea. *Catesby.*—Ammophila cyanea. *Kirby.*

The insects which this fly secures for its young are principally spiders. This will in some measure account for its generally forming its cell under roofs of buildings, and in other places where spiders are usually found. It does not kill them, but only in some manner so disables them that they cannot escape; by which means they are preserved alive and uncorrupted until the young larva is produced, which is not long after the egg is deposited. They sometimes seize and fly off with spiders that are equal in size to themselves; and when one of them proves too weighty to be thus carried off, if it is not at a great distance, the insect drags it to her nest. Mr. Catesby once saw an exceedingly large spider dragged up a wall by one of these flies to its nest; and both of them being caught and weighed, it was found that the spider was eight times the weight of the fly.

By the time the larva has devoured all its provision, it is ready to undergo its change; and for this purpose spins itself up in a fine soft silken case about the end of September, and remains in a chrysalis state until the spring; when it gnaws its way out of the clayey dwelling, and becomes an inhabitant of the air.

THE PENNSYLVANIAN SAND-WASP *.

The nest of this species, as well as that of the last, is formed with considerable art and ingenuity. The insect

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* Description. This Sand-wasp is about an inch long, and of a black colour, with the wings inclining to violet. It is an inhabitant of North America, where it feeds on grasshoppers and other insects, as well as on various kinds of fruit.

Synonyms. Sphex Pennsylvanica. *Linn?*—Ammophila Pennsylvanica. *Kirby.*—Great Black Wasp from Pennsylvania. *Bartram.*

scratches in the steep side of some bank of loamy earth a horizontal hole, about an inch in diameter, and nearly a foot long, making it smooth within, and pressing the earth so strongly as to secure it from giving way. She then flies off and seizes one of the large green grasshoppers, and lodges it safely at the further end. After laying an egg, she again goes off and catches two others, which she deposits with the former, and then closes up the hole. The larva, when produced, feeds on the bodies of the grasshoppers until its change into a chrysalis. It remains in this state for some time; but when it becomes perfected it eats its way out, and flies off.

The grasshoppers caught for the young are often much larger and more strong than the parent insect, so that considerable care is necessary in attacking them. She is said to seize them suddenly, and to plunge her sting into their body in such a manner as not to kill, but merely to render them inactive; for, as in the last species, it is necessary that they should be kept alive for some sime in the nest, or they would otherwise putrify, and become unfit for the purpose they were designed to answer.

*OF THE WASP TRIBE**.

The Wasps are in general found in large societies like the bees, constructing curious combs or nests, in which they deposit their eggs. Some, however, are solitary, and form for each young one a separate nest. Their *larvæ* are soft, without feet, and are fed with the nectar of flowers and honey, but of a kind very inferior to that collected by the

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* The mouth is horny, and furnished with a compressive jaw, and four unequal, thread-shaped feelers. The antennæ are also filiform, the first joint longer than the rest, and cylindrical. The sting is pungent, and concealed within the abdomen.

bees. The *chrysalis* is without motion, and has the rudiments of wings.

A distinguishing popular character of this tribe is their having smooth bodies, apparently without hairs, and their upper wings, when at rest, folded through their whole length. At the base of each of these there is a scaly process, that performs the office of a spring, in preventing them from rising too high ; a caution of some importance to these carnivorous insects, which pursue their prey at full stretch of wing.

THE HORNET *.

It is chiefly in the hollow trunks of decayed trees that the Hornets form their nest. They live collected together in communities, which consist of males, females, and neuters or labourers. Their nest is of a dirty yellowish colour, and usually constructed under the shelter of some outhouse, in the hole of an old wall, or more frequently in the hollow trunk of some decayed tree. The hole of entrance to this nest is oftentimes not more than an inch in diameter.

In the spring of the year, those of the females which have survived the winter, are reanimated by the warmth of the season, issue from their hiding-places, and search out a convenient place in which they can establish their nest. When this is found, they commence their first operation by forming a column, of the same materials as those which are afterwards employed in the other parts of the fabric, but much more compact and solid. This column the fe-

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* Description. This is an insect of large size. The thorax is black, the fore-part rufous. The extremity of the abdomen is yellow, with three black points on each segment.

Synonyms. Vespa crabro. *Linn.*—Le Frélon. *Cuvier.*

male fixes in the most elevated part of the vault, which is intended to contain the nest. A kind of cover is next formed, and then a small comb of hexagonal cells, with their openings downward, for the purpose of containing her eggs and the grubs which issue from them.

The eggs are soon hatched, and the mother nourishes her offspring with food which she brings to them from abroad. When the grubs have attained their full size, they each spin a silken bed, in which they undergo their metamorphoses into *pupæ*, and afterwards into perfect or winged insects.

Those first produced are the neuters. These are the working insects, or labourers; that is to say, they are from this period occupied in the work of constructing, and in the duty of nourishing the remaining grubs.

The females still continuing to lay, the family is consequently augmented; and the nest becoming now too small, necessity requires it to be enlarged. This operation falls wholly upon the labourers.

It is only in the month of September and the beginning of October that the brood of males and females quit their *pupæ* state. All that are left, whether males, females, or neuters, are generally put to death before the end of October, particularly if the frosts have at all begun to be felt. The Hornets, in place of continuing to nourish the remaining grubs, are now occupied only in tearing in pieces the cells, and throwing them out of the nest. After this period both the males and the neuters daily perish in great numbers; so that, by the end of winter, the females, which are enabled to pass that season in a torpid state, are the only ones which are left alive.

Thus terminates this society, of which the greatest population does not often exceed the number of a hundred or a hundred and fifty individuals.

The combs are composed of a substance which somewhat resembles coarse paper or old parchment.

These insects are extremely voracious, seizing upon, and devouring with great eagerness, other insects, and frequently even bees. Their size gives them, in some respects, a superiority over almost all the flies which they attack; but as, in consequence of this, they are somewhat slow and heavy in their flight, these are frequently able, by their greater agility, to escape.

THE COMMON WASP*.

The nest of the Common Wasp is always formed under the surface of the earth, and these insects not unfrequently occupy with it the forsaken dwelling of a mole. The entrance to it is usually about an inch in diameter, from half a foot to two feet deep, and generally in a zigzag direction.

When exposed to the view, the whole nest appears to be of a roundish form, and is twelve or fourteen inches in diameter. It is strongly fortified all round with walls, in layers, formed of a substance somewhat like paper, the surface of which is rough and irregular. In these walls, or rather in this external covering, two holes are left for passages to the combs, one of which is uniformly adopted for entrance, and the other as a passage out. The interior of the nest consists of several stories or floors of combs, which are parallel to each other, and nearly in an horizontal position. Every story is composed of a numerous assemblage of hexagonal cells. These contain neither wax nor honey, but are solely destined for containing the eggs, the worms which are hatched from them, the chrysalids, and

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* SYNONYMS. Vespa vulgaris. *Linn.*—La Guèpe commune, in France.

the young Wasps, until they are able to fly. The combs are from eleven to fifteen in number. Reaumur computed the number of cells in the combs of a middle-sized nest to be at least ten thousand; and, as every cell serves for no fewer than three generations, a nest of this description would annually give birth to *thirty thousand* young Wasps.

The different stories of combs are always about half an inch distant, which leaves free passages to the Wasps from one part of the nest to another. Each of the larger combs is supported by about fifty pillars, which, at the same time that they give solidity to the fabric, greatly ornament the whole nest. The lesser combs are supported by the same contrivance. The Wasps always begin at the top and work downward.

M. de Reaumur, in order to examine some parts of the internal economy of these insects, contrived to make them lodge and work in glass hives, like the honey-bees. Their extreme affection for their offspring aided him greatly in this; for he found that, although their nests were cut in various directions, and even exposed to the light, they never deserted them, nor relaxed in their attentions to the young.

Immediately after a Wasp's nest had been transported from its natural situation, and covered with a glass hive, the first operation of the insects was to repair the injuries it had suffered. With wonderful activity they carried off all the earth and foreign bodies that had accidentally been conveyed into the hive. Some of them occupied themselves in fixing the nest to the top and sides of the hive by pillars of paper, similar to those that support the different stories or strata of combs; others repaired the breaches it had sustained; and others fortified it, by augmenting the thickness of its external cover.

In the formation of their nests, Wasps differ greatly from the bees. Instead of collecting the farina of flowers, and

digesting it into wax, they gnaw small fibres of wood from the sashes of windows, the posts and doors of gardens, or old rails, which their strong and serrated jaws enable them to do with great ease.—These fibres, though very slender, are often a tenth of an inch in length. After cutting a certain number, they collect them into small bundles, transport them to their nest; and, by means of a glutinous substance furnished from their own bodies, the labouring Wasps, which are employed in the nests, form them into a moist and ductile paste. Of this substance they construct the external cover, the partition of the nest, and hexagonal cells, and the solid columns that support the several stories of the comb.

In the republic of Wasps, like that of the Bees, there are three different kinds of flies; males, females, and neuters. The greatest share of labour devolves upon the neuters: but they are not, like the neuter bees, the only workers; for there is no part of the different operations which the females, at certain times, do not execute. Nor do the males remain entirely idle. The neuters, however, build the nest, feed the males, the females, and even the young. But, while these are occupied in different employments at home, the others are abroad in hunting parties. Some of them attack with intrepidity live insects, which they sometimes carry entire to the nest; but if these are at all large, they transport only the abdomen. Others make war on the bees, killing them for the honey they have in their bodies, or plundering their hives for the fruits of their labour. Some resort to the gardens, and suck the juices of fruit; and others pillage butchers' stalls, from which they often arrive with a piece of meat larger than even half of their own bodies.

When they return to their nest they distribute a part of their plunder to the females, to the males, and to such neuters as have been usefully occupied at home. As soon

as a neuter enters the nest, it is surrounded by several Wasps, to each of which it freely gives a portion of the food it has brought. Those that have not been hunting for prey, but have been sucking the juices of fruits, though they seem to return empty, fail not to regale their companions; for, after their arrival, they station themselves on the upper part of the nest, and discharge from their mouths two or three drops of clear liquid, which are immediately swallowed by the domestics.

The neuter Wasps are the smallest, the females are much larger and heavier, and the males are of an intermediate size between the two. In the hive of the Honey-bee, the number of females is extremely small; but in a Wasp's nest they often amount to more than three hundred.

The eggs are white, transparent, and of an oblong shape; but they differ in size, according to the kind of Wasps that are to proceed from them.—Eight days after they are deposited in the cells, the grubs are hatched. These demand the principal care of those Wasps that continue always in the nest. They feed them as birds feed their young ones, by giving them, from time to time, a mouthful of food. It is astonishing to see with what industry and rapidity a female runs along the cells of a comb, and distributes to each worm a portion of nutriment. In proportion to the ages and conditions of the worms, they are fed with solid food, such as the bellies of insects, or with a liquid substance disgorged by their foster parent.

When a worm is so large as to occupy its whole cell, it is ready to be metamorphosed into a chrysalis. It then refuses all nourishment, and ceases to have any connexion with the Wasps in the nest. It shuts up the mouth of its cell with a fine silken cover. This operation is completed in three or four hours, and the animal remains a chrysalis nine or ten days; when, with its teeth, it destroys the

external cover of the cell, and issues forth a winged insect, which is either male, female, or neuter, according to the nature of the egg from which it was hatched. In a short time the Wasps newly transformed receive the food brought into the nest by the foragers from the fields. What is still more wonderful is, that in the course of even the first day after their transformation, the young Wasps have been observed going to the fields, bringing in provisions, and distributing them to the worms in the cells.—A cell is no sooner abandoned by a young Wasp, than it is cleaned, trimmed, and repaired by the old ones, and rendered in every respect proper for the reception of another egg.

Cells are constructed of different dimensions for the neuters, males, and females; and it is very remarkable, that those of the neuters are never intermixed with the cells destined for others.

This wonderful edifice, which requires the labour of the animals for several months, serves them only for a year; and, notwithstanding its population during the summer, it is almost deserted in winter, and is abandoned entirely in the spring; for, in this last season, not a single Wasp is to be found in a nest of the preceding year. It is worthy of remark, that the first combs of a nest are always accommodated for the reception of the neuter or working Wasps, whose care and attention are first required; so that it uniformly happens, that before the males and females are capable of taking flight, every Wasp's nest is peopled with several thousands of neuters or workers. But the neuters, which are first produced, are likewise the first that perish; for not one of them survives the termination even of a mild winter.

The female Wasps are stronger, and support the rigours of winter better than either the males or neuters. Before the end of winter, however, several hundred females die, and not above ten or a dozen in each nest survive that

season. These few females are destined for the continuation of the species. Each of them becomes the founder of a new republic. With regard to the male Wasps, it is uncertain whether any of them survive. But, though not so indolent as the males of the honey-bee, they can be of but little assistance to the female; for they never engage in any work of importance, such as constructing cells, or fortifying the external cover of the nest. They are never brought forth till towards the end of August; and their sole occupation seems to be that of keeping the nest clean; they carry out every kind of filth, and the bodies of such of their companions as happen to die. In performing this operation, two of them often join; and when the load is too heavy, they cut off the head, and transport the dead ainmal at twice.

Every nest, about the beginning of October, presents a strange scene of cruelty. At this season, the Wasps not only cease to bring nourishment to their young, but drag the grubs from their cells, and carry them out of the nest, where, exposed to the weather, and deprived of food, they all unavoidably perish, if the Wasps neglect, which they seldom do, to kill them with their fangs. This procedure would at first seem a strange violation of parental affection; but the intentions of nature, though they often elude our researches, are never wrong. What appears to us cruel and unnatural in this instinctive devastation committed annually by the Wasps, is perhaps an act of the greatest mercy and compassion that could possibly have taken place. Wasps are not, like the honey-bees, endowed with the instinct of laying up a store of provisions for winter subsistence. If not prematurely destroyed by their parents, the young ones must necessarily die a cruel and lingering death, occasioned by hunger. Hence this seemingly harsh conduct in the economy of Wasps, instead of affording an

exception to the universal benevolence and wisdom of nature, is, in reality, a most merciful effort of instinct.

Like the male honey-bees, the male Wasps are destitute of stings; but the females and neuters have stings, the poisonous liquor of which, when introduced into any part of the human body, excites inflammation, and creates a considerable degree of pain. This sting consists of a hollow and very sharp-pointed tube, having at its root a bag of pungent juice, which, in the act of stinging, is pressed out, and conveyed through the tube into the flesh. —There are also two small, sharp, and bearded spears, lying, as in a sheath, within the tube. Dr. Derham counted eight beards on the side of each spear, which, he says, were formed somewhat like the beards of fish-hooks. These spears lie one with its points a little before the other in the sheath, to be ready, in all probability, to be first darted into the flesh; where, being once fixed, by means of its foremost beard, the other then strikes in also; and they in this manner alternately pierce deeper and deeper, their beards taking more and more hold in the flesh; after which the sting or sheath follows, in order to convey the poison into the wound. The hole in the tube is not exactly at the end, for in that case the instrument would not be so well able to wound: the sting is drawn to a hard and sharp point, and the incision through which the spears and poison are ejected, is a little below it. By means of this mechanism it is, that the sting, even when parted from the body, is able to pierce and make us smart; and by means of the beards being lodged deep in the flesh, it is also that these insects leave their stings behind them, when they are disturbed before they have had time to withdraw their spears completely into the tube.

THE CAMPANULAR WASP *.

In the summer of 1807, I found the nest of one of these Wasps, suspended to the rafter of a small bathing house, belonging to a gentleman in the parish of Christchurch, Hants. It was of a somewhat globular shape, and in size about twice as large as a walnut.

The nidification of this insect, as Dr. Shaw, in his Naturalist's Miscellany, has remarked, is scarcely less curious than that of a bird. It is usually suspended from the upper part of some barn or outhouse, and consists of three or four, and sometimes more, concentric globes, of a consistence somewhat resembling whity-brown paper, with a small circular opening at the bottom. In the middle of the interior or central globe, is placed the congeries of cells, to the number of twelve, fifteen, or twenty. These are arranged round a kind of central column, and are composed of the same paper-like substance with the other parts; the exterior circle of cells being somewhat lower or shorter than the rest. These curious nests are usually found from about the middle of June, to the beginning of October.

OF THE BEES IN GENERAL†.

These insects are very numerous, and differ considerably in their habits. Some of the species are found in extensive

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* Description. This insect has a yellowish line on each side of the thorax, two yellowish spots on the scutellum, and a yellowish abdomen, with transverse black rings, accompanied by black spots at their ends.

Synonyms. Vespa campanaria. *Shaw.*—Vespa Holsatica. *Latreille*—La Guêpe de Holstein. *Latreille.*

† The Bees, according to the generic character given of them by Linnæus, have a horny mouth, with the jaws and the lip membra-

communities, constructing, with the utmost art, cells for their offspring, and repositories for their food; while others both dwell and work in solitude. The whole tribe live on the nectar of flowers, and on ripe fruit.

Their *larvæ* are soft and without feet, and the *chrysalis* resembles the perfect insect.

THE POPPY BEE*.

The Poppy Bee forms her nest in the ground, burrowing to the depth of about three inches. At the bottom

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naceous at the end: the tongue is inflected; and they have four unequal, thread-shaped feelers. Their antennæ are short and filiform, but those of the female somewhat club-shaped. The wings are flat; and the females and neuters have pungent stings concealed in the abdomen.

The English Bees have undergone an accurate investigation by the Rev. Mr. Kirby, who has discovered no fewer than *two hundred and twenty-one* distinct species, though fifteen years ago none of our books mentioned so many as a dozen. He divides the Linnæan genus into *Melitta* and *Apis*, distinguishing them by their tongues; the insects of the former having short, flattish, uninflected tongues; and those of the other long, cylindrical, and inflected tongues, easily examined by raising them with a pin from the sheath in which they are concealed.

* DESCRIPTION. This is a little black Bee, about the third of an inch in length. Its head and trunk are thickly covered with hairs of a dirty-gray colour; and the under parts of its body are clad with grayish hairs. The abdomen is somewhat conical, black, and shining; but its segments are fringed with white hairs. The *male* is nearly of the same length as the female, but rather narrower, and somewhat more hairy. Its abdomen is inflexed, and not so hairy underneath as above. The last segment terminates in a fork with blunt teeth, and has on each side of its base a sharp spine or point.

SYNONYMS. Apis Papaveris. *Kirby,* i. 142. 214.—Abeille tapissière. *Reaumur.*—Mégachile du Pavot. *Latreille.*

she makes a large and somewhat hemispherical cavity, which, after being rendered perfectly smooth on all sides, she carefully lines with a splendid tapestry, selected from the scarlet flowers of the wild poppy. From these, with great dexterity, she cuts pieces of proper size and form, which she conveys to her cell; and, beginning at the bottom, covers with it the whole interior of this habitation of her future progeny. If the piece she has cut out and transported, be found too large for the place she intends it to fit, she clips off the superfluous parts, and conveys the shreds out of the apartment. The covering is even sometimes extended a little way round the orifice. The bottom is rendered warm by three or four coats, and the sides have never less than two. When the little animal has completed her apartment, she fills it with paste, made of pollen and honey, to the height of about half an inch; and, after depositing an egg, she pushes down the poppy-lining until it completely covers the cell, and then closes up its mouth with earth so nicely, as to render it not distinguishable from the adjoining soil.

THE LEAF-CUTTING BEE *.

These Bees construct cylindrical nests of the leaves of the rose and other trees, which are sometimes of the length of six inches, and generally consist of six or seven cells, each shaped like a thimble. They are formed with the convex end of one fitting into the open end of another. The portions of leaf of which they are made are not glued

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* Description. The general colour of this Bee is brown. The segments of the abdomen are bordered with white at the sides; and the under part of its extremity is red.

Synonyms. Apis centuncularis, *Linn.*—L'Abeille coupeuse de Rosier. *Cuvier.*—Mégachile centunculaire. *Latreille.*

together, nor are they any otherwise fastened, than in the nicety of their adjustment to each other; and yet they do not admit the liquid honey to drain through them. The interior surface of each cell consists of three pieces of leaf, of equal size, narrow at one end, but gradually widening to the other, where the width equals half the length. One side of each of these pieces, is the serrated margin of the leaf from which it was cut. In forming the cell, the pieces of leaf are made to lap one over the other, (the serrated side always outermost,) till a tube is thus formed, coated with three, four, or more layers. In coating these tubes, the provident little animal is careful to lay the middle of each piece of leaf over the margins of others, so as, by this means, both to cover and strengthen the junctions. At the closed or narrow end of the cell, the leaves are bent down so as to form a convex termination. When a cell is formed, the next care of the Bee is to fill it with honey and pollen, which, being collected chiefly from the thistles, form a rose-coloured paste. With these it is filled to within about half a line of the orifice; and she then deposits in it an egg, and closes it with three perfectly circular pieces of leaf, which coincide so exactly with the walls of the cylindrical cell, as to be retained in their situation without any gluten. After this covering is fitted in, there still remains a hollow, which receives the convex end of the succeeding cell. In this manner the patient and indefatigable animal proceeds, till her whole cylinder of six or seven cells is completed. This is generally formed under the surface of the ground, in a fistular passage, which it entirely fills, except at the entrance. If the labour of these insects is interrupted, or the edifice is deranged, they exhibit astonishing perseverance in setting it again to rights.

Their mode of cutting pieces out of the leaves for their work, deserves particular notice. When one of these Bees

selects a rose-bush with this view, she flies round or hovers over it for some seconds, as if examining for the leaves best suited to her purpose. When she has chosen one, she alights upon it, sometimes on the upper, and sometimes on the under surface, or not unfrequently on its edge, so that the margin passes between her legs. Her first attack, which is generally made the moment she alights, is usually near the footstalk, with her head turned towards the point. As soon as she begins to cut, she is entirely intent on her labour; nor does she cease till her work is completed: this is done, with her strong jaws, with as much expedition as we could exert with a pair of scissars. As she proceeds, she keeps the margin of the detached part between her legs in such a manner, that the section keeps giving way to her, and does not interrupt her progress.—She makes her incision in a curve line, approaching the midrib of the leaf at first; but when she has reached a certain point, she recedes from this towards the margin, still cutting in a curve. When she has nearly detached the portion she has been employed upon from the leaf, she balances her little wings for flight, lest its weight should carry her to the ground; and the very moment it parts, she flies off with it in triumph, in a bent position between her legs, and perpendicularly to her body.

The larvæ of the Leaf-cutting Bees do not differ in appearance from those of the Hive-bees. When arrived at their full size, they spin a coccoon of silk, thick and solid, which they attach to the sides of their cell. Those produced first, are from the first-laid eggs; so that, when ready to emerge into the air, in passing through the bottom of their cells, they do not interrupt each other's progress. These larvæ are exposed to the attacks of other insects, that make their way into the cells, and deposit there their eggs.

This mode of forming a nest is not confined to the present species, as several others perform similar operations: but they adopt the leaves of different trees for this purpose; such as the horse-chesnut, the elm, &c.

THE GARDEN BEE*.

This singular little insect is very common about gardens in or near towns. It forms its nest in hollow places in trees, &c. applying to this work the down of the garden campion †, and some other woolly plants. The Rev. Mr. White of Selborne, seems to have been the first naturalist who discovered it. He says, "it is very pleasant to see with what address this insect strips off the down, running from the top to the bottom of a branch, and shaving it bare with all the dexterity of a hoop-shaver. When it has got a vast bundle, almost as large as itself, it flies away, holding it secure between its chin and fore-legs."

Sir Thomas Cullum, in a letter to Mr. Marsham, states that, the key not easily turning round in the lock of one of his garden gates, he looked into the key-hole, and, observing in it something white, ordered the lock to be taken off. This was found completely full of a downy substance, and contained the chrysalids of some bee. The down, as Sir Thomas conceived, was of the *Anemone Sylvestris*, of which there were two plants in his garden. He preserved the whole as he found it, but none of the

* Description. The length of this insect is from half an inch, to three quarters of an inch. It is of a dark colour, and hairy. On each side of the abdomen there are several yellow spots.

Synonyms. Apis manicata. *Linn.*—L'Abeille à cinq Crochets. *Tigny.*—Mégachile à cinque Crochets. *Latreille.*

† *Agrostemma coronaria* of Linnæus.

bees contained in it had then made their appearance in a perfect state. This nidus was afterwards sent to the Rev. Mr. Kirby, and five of the chrysalids produced perfect insects; namely, three males, and two females. On comparing the down of which it was composed, with that of the campion, Mr. K. was of opinion, that Sir Thomas Cullum had mistaken its composition, as the down of the anemone is of a more silky texture than that used in this nest. This gentleman informs us, that there were several cells or cases in the lock, unconnected with each other except by the wool, which was their common covering. These cells were of an oval form, and had an exterior coat of wool, under which there was a membranaceous cell, covered with a number of small vermiform masses of a brown substance, apparently formed of pollen and honey. These were laid, without any regular order, over the cell; and, by means of them, the wool which formed its exterior coat, was made to adhere. At the summit of this membranaceous case there was a small orifice, and within it another cell, somewhat strong and coriaceous, of a brown colour, and shining in the inside as much as if covered with tinfoil. This was supposed to be the coccoon of the larva previously to its assuming the pupa state.

THE MASON BEE*.

The Mason Bee, which is also one of the solitary species, derives its name from the circumstance of its constructing

* Description. The Mason Bee is about nine lines, or three quarters of an inch in length. Its body is black, and thickly clad with black hairs. The jaws are large and prominent, and terminate in two blunt teeth. The wings are black, with a tinge of violet. The abdomen is somewhat conical, and has underneath a patch of

a nest of mud or mortar. This, on its exterior, has so little of a regular appearance, that it is generally regarded as a piece of dirt accidentally adhering to a wall. Within, however, it is furnished with regular cells, each of which affords convenient lodgment to a white larva, much resembling that of the hive-bee. In constructing this nest, which is a work of great labour and art, the female is the sole operator, receiving no assistance whatever from the male.

After fixing upon an angle, sheltered by any projection, on the south side of a stone wall, or upon some rough part of its surface, she goes in quest of the necessary materials. Her nest is to be constructed of a kind of mortar, of which sand is to be the basis. She is very curious in her choice of this, selecting it with her jaws, grain by grain. To shorten her labour, before she transports it for use, she glues together, by means of a viscid saliva from her body, as many grains as she can carry: these form a little mass, about the size of a small shot. Taking this up in her jaws, she conveys it to the place she has fixed upon for the site of her house. She labours incessantly till her whole work is completed, which usually occupies five or six days. The number of cells in one nest is from three to fifteen: these are all similar, and nearly equal in dimensions, each being about an inch high, half an inch in diameter; and, before its orifice is closed, resembling a thimble in shape. When a cell is raised to somewhat

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orange-coloured hairs. The terminating joints of the legs are reddish.—The *male* is covered with red hairs.

SYNONYMS. Abeille Maçonne. *Reaumur*.—It is not known to which of the Linnæan species this Bee is to be referred. Fabricius calls it *Apis muraria*: but he has described the male for the female; and, *viçe versâ*, the female for the male.—Apis muraria. *Tigny*.—Apis comentaria. *Cuvier*.

more than half its height, our little mason lays up in it a store of pollen, seasoned with honey, for the sustenance of its future inhabitant. This being done, she deposits her egg, finishes and covers her cell, and then proceeds to the erection of a second, which she furnishes and finishes in the same manner; and so on till the work is completed. These cells are not placed in any regular order: some are parallel with the wall, others perpendicular to it, and others are inclined to it at different angles. This occasions many empty spaces between the cells, which the laborious architect fills up with the same kind of cement, and then bestows on the whole group a common covering, made with coarser grains of sand; so that at length, the nest becomes a mass of mortar, so hard as not easily to be penetrated even by the blade of a knife.

These nests, which sometimes last for several seasons, are often the cause of desperate conflicts.—When one insect has taken possession of a nest, and is gone abroad in quest of materials to repair it, another will frequently come to seize upon it. If they meet, a battle invariably ensues. This is always fought in the air. Sometimes the two Bees fly with such rapidity and force against each other, that both fall to the ground. But in general, like birds of prey, the one endeavours to rise above the other, and to give a downward blow. To avoid the stroke, the undermost, instead of flying forward, or laterally, is frequently observed to fly backward. This retrograde flight is likewise performed occasionally by the common house-fly, and some other insects, though we are unable to perceive what stimulates them to employ so uncommon a movement.

From the hardness of the materials with which the Mason Bee constructs her nest, and from the industry and dexterity she employs to protect her progeny from enemies of every kind, one should naturally imagine that the

young ones would be in perfect safety, and that their castle would be impregnable. But, notwithstanding all these precautions, they are often devoured by the larvæ of a peculiar species of ichneumon fly, the eggs of which are deposited in the cells before the Bee has completed them. They have also an enemy even more formidable than the ichneumons. A species of beetle* insinuates its egg into an unfinished cell: from this proceeds a strong and rapacious grub, armed with prodigious fangs, which often pierces through every cell in the nest, and successively devours all the inhabitants.

THE WOOD-PIERCING BEE*.

The operations of the Wood-piercers merit our careful attention. In the spring of the year they frequent gardens, and search for rotten, or at least for dead wood, in order to make a habitation for their young. They usually choose the decaying uprights of arbours, espaliers, or the props of vines; but will sometimes attack garden seats, thick doors, and window shutters.

When the female of this species, for she receives no assistance from the male, has selected a piece of wood suited to her purpose, which is most commonly such as is perpendicular to the horizon, she begins her work by boring perpendicularly into it: when she has advanced about half an inch, she changes her direction, and then proceeds nearly parallel with its sides, for twelve or fifteen

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* *Attelabus apiarius* of Linnæus.

* DESCRIPTION. These Bees are larger than the queens of the Honey-bee. Their bodies are smooth, except the sides, which are covered with hair.

SYNONYMS. Apis violacea. *Linn.*—L'Abeille perce-bois. *Cuvier.*—Xylocope violette. *Latreille.*

inches, making the hollow about half an inch in diameter. If the wood be sufficiently thick, she sometimes forms three or four of these long holes in its interior; a labour, which for a single insect, seems prodigious; and in the execution of it some weeks are often employed. On the ground, for about a foot from the place in which one of these Bees is working, little heaps of timber dust are to be seen. These heaps daily increase in size, and the particles that compose them are almost as large as those produced by a hand-saw. The strong jaws of this insect are the only instruments she employs in these perforations. After the holes are prepared, they are divided into ten or twelve separate apartments, each about an inch deep, the roof of one serving for the bottom of another. The divisions are composed of particles of wood, cemented together by a glutinous substance from the animal's body. In making one of these, she commences by glueing an annular plate of wood-dust, about the thickness of half-a-crown, round the internal circumference of the cavity: to this plate she attaches a second, to the second a third, and so on till the whole floor is completed. Before each cell is closed, it is filled with a paste composed of the fariña of flowers mixed with honey, and an egg is deposited in it. When the larva is hatched, it has scarcely room sufficient to turn itself in the cell; but as the paste is devoured, the space is enlarged so as to allow it to perform every necessary operation towards changing its state.

We are informed by M. de Reaumur, that M. Pitot furnished him with a piece of wood, about an inch and a half in diameter, that contained the cells of one of these Bees. He cut off as much of the wood as was sufficient to expose two of the cells to view, in each of which there was a larva. To prevent the injuries of the air, he closed the aperture that he had made, by pasting on it a bit of glass. The cells were at that time almost entirely filled

with paste. The two worms were exceedingly small, and, of course, occupied but little space between the walls of the cells and the mass of paste. As the animals increased in size, the paste daily diminished. He began to observe them on the 12th of June; and on the 27th of the same month, the paste in each cell was nearly consumed, and the worm, folded in two, occupied the greater part of its habitation. On the 2d of July, the provisions of both worms were entirely exhausted. The five or six following days they fasted, which seemed to be a necessary abstinence, during which they were greatly agitated. They often bent their bodies, and elevated and depressed their heads. These movements were preparatory to the great change which the animals were about to undergo. Between the 7th and 8th of the same month they threw off their skins, and were metamorphosed into nymphs; and on the 30th of July they became perfect insects.

In a range of cells, the worms are necessarily of different ages, and of course of different sizes. Those in the lower ones are older than those in the upper; because, after the Bee has filled with paste, and enclosed the first cell, a considerable time is requisite to collect provisions, and to form partitions for every successive and superior cell. The former, therefore, must be transformed into nymphs and flies before the latter. These circumstances would almost appear to be foreseen by the mother; for if the undermost worm, which is the oldest, and soonest transformed, was to force its way upward, which it could easily do, it would not only disturb, but infallibly destroy all those lodged in the superior cells. But Nature has wisely prevented this devastation; for the head of the nymph, and consequently of the fly, is always placed in a downward direction. Its first instinctive movements must, therefore, be in the same direction. That the young flies may escape from their respective cells, the mother

digs a hole at the bottom of the long tube, which makes a communication between the undermost cell and the open air. Sometimes a similar passage is made near the middle of the tube. By this contrivance, as all the flies instinctively endeavour to cut their way downward, they find an easy and convenient passage; for they have only to pierce the floor of their cells in order to make their escape, and this they do with their teeth very readily.

THE HIVE BEE*.

In the formation of their combs, the present insects seem to resolve a problem which would not be a little puzzling to some geometricians, namely, "A quantity of wax being "given, to make of it equal and similar cells of a determin- "ed capacity, but of the largest size in proportion to the "quantity of matter employed, and disposed in such a "manner as to occupy in the hive the least possible "space." Every part of this problem is completely executed by the Bees. By applying hexagonal cells to each others' sides, no void spaces are left between them; and, though the same end might be accomplished by other figures, yet such would necessarily require a greater quantity of wax. Besides, hexagonal cells are better fitted to receive the cylindrical bodies of these insects. A comb consists of two strata of cells applied to each other's ends. This arrangement both saves room in the hive, and gives a double entry into the cells of which the comb is composed. As a further saving of wax, and for preventing void spaces, the bases of the cells in one stratum of a comb

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* SYNONYMS. Apis mellifica. *Linn.*—Honey-bee, in various parts of the country.—The males are called *Drones*, and the female the *Queen-bee*. The neuters are called *Working-bees*.—L'Abeille à miel, in France.

serve also for bases to the opposite stratum. In short, the more minutely the construction is examined, the more will the admiration of the observer be excited. The walls of the cells are so extremely thin that their mouths might be thought in danger of suffering by the frequent entering and issuing of the Bees. To prevent this disaster, they make a kind of rim round the margin of each cell, and this rim is three or four times thicker than the walls.

It is difficult to perceive, even with the assistance of glass hives, the manner in which Bees operate when constructing their cells. They are so eager to afford mutual assistance, and for this purpose so many of them crowd together, and are perpetually succeeding each other, that their individual operations can seldom be distinctly observed. It has, however, been plainly discovered that their two jaws are the only instruments they employ in modelling and polishing the wax. With a little patience and attention, we perceive cells just begun: we likewise remark the quickness with which a Bee moves its teeth against a small portion of the cell. This portion the animal, by repeated strokes on each side, smooths, renders compact, and reduces to a proper thinness. While some of the hive are lengthening their hexagonal tubes, others are laying the foundations of new ones. In certain circumstances, when extremely hurried, they do not complete their new cells, but leave them imperfect until they have begun a number sufficient for their present exigencies. When a Bee puts its head a little way into a cell, we easily perceive it scraping the walls with the points of its teeth, in order to detach such useless and irregular fragments as may have been left in the work. Of these fragments the Bee forms a ball about the size of a pin's head, comes out of the cell, and carries this wax to another part of the work, where it is wanted: it no sooner leaves the cell, than it is succeeded by another Bee, which performs the same office; and in

this manner the work is successively carried on till the cell is completely polished.

Their mode of working, and the disposition and division of their labour, when put into an empty hive, do much honour to the sagacity of Bees. They immediately begin to lay the foundations of their combs, which they execute with surprising quickness and alacrity. Soon after they begin to construct one comb; they divide into two or three companies, each of which, in different parts of the hive, is occupied in the same operations. By this division of labour, a great number of Bees have an opportunity of being employed at the same time, and, consequently, the common work is sooner finished. The combs are generally arranged in a direction parallel to each other. An interval or street between them is always left, that the Bees may have a free passage, and an easy communication with the different combs in the hive. These streets are just wide enough to allow two Bees to pass one another. Beside these parallel streets, to shorten their journey when working, they leave several cross passages, which are always covered.

They are extremely solicitous to prevent insects of any kind from getting admittance into their hives. To accomplish this purpose, and in order to shut out the cold, when they take possession of a new hive, they carefully examine every part of it; and if they discover any small holes or chinks, they immediately paste them firmly up with a resinous substance, which differs considerably from wax. This substance was known to the ancients by the name of *propolis*, or bee-glue. Bees use the propolis for rendering their hives more close and perfect, in preference to wax, because it is more durable, and more powerfully resists the vicissitudes of weather. This glue is not, like the wax, procured by an animal process. The Bees collect it from different trees, as the poplar, birch, and willow. It is a complete production of nature, and requires no ad-

ditional manufacture from the animals by which it is employed. After a Bee has procured a quantity sufficient to fill the cavities of its two hind-legs, it repairs to the hive. Two of its companions instantly draw out the propolis, and apply it to fill up such chinks, holes, or other deficiencies, as they find in their habitation. But this is not the only use to which Bees apply the propolis. They are extremely solicitous to remove such insects or foreign bodies as happen to get admission into the hive. When so light as not to exceed their powers, they first kill the insect with their stings, and then drag it out with their teeth. But it sometimes happens that an ill-fated snail creeps into the hive. This is no sooner perceived than it is attacked on all sides and stung to death. But how are the Bees to carry out so heavy a burthen? Such a labour would be in vain. To prevent the noxious odours consequent on its putrefaction, they immediately embalm it, by covering every part of its body with propolis, through which no effluvia can escape.

But propolis, and the materials for making wax, are not the only substances which these industrious animals have to collect. As, besides the whole winter, there are many days in summer in which the Bees are prevented by the weather from going abroad in quest of provisions; they are, therefore, under the necessity of collecting and amassing, in cells destined for that purpose, large quantities of honey. This they extract, by means of their trunk, from the nectariferous glands of flowers. The trunk of the Bee is a kind of rough, cartilaginous tongue. After collecting a few small drops of honey with this, the animal carries them to its mouth, and swallows them. From the gullet they pass into the first stomach. This, when filled with honey, assumes the figure of an oblong bladder, the membrane of which is so thin and transparent, that it allows the colour of the liquid it contains to be distinctly seen.

As soon as their stomach is full, the Bees return directly to the hive, and disgorge into a cell the whole of the honey they have collected. It not unfrequently happens, however, that on its way to the hive the Bee is accosted by a hungry companion. How the one manages to communicate its wants to the other, it is perhaps impossible to discover. But the fact is certain, that when two Bees meet in this situation, they mutually stop, and the one whose stomach is full of honey extends its trunk, opens its mouth, and, like a ruminating animal, forces up the honey. The hungry Bee, with the point of its trunk, sucks the honey from the other's mouth. When not stopped on the road, the Bee, as before stated, proceeds to the hive, and in the same manner offers its honey to those who are at work, as if it meant to prevent the necessity of their quitting their labour in order to go in quest of food. In bad weather, the Bees feed on the honey laid up in open cells; but they never touch their reservoirs while their companions are enabled to supply them with fresh honey from the fields. The mouths of those cells which are destined for preserving honey during the winter, they always cover with a lid or thin plate of wax.

How numerous soever the Bees in one swarm may appear to be, they all originate from a single parent. It is indeed surprising, that one small insect should in a few months give birth to so many young ones; but, on opening her body at a certain season of the year, eggs to the number of many thousands are to be found contained in it.

The queen is easily distinguished from the rest by the size and shape of her body. On her depends the welfare of the whole community; and, by the attention that is paid to all her movements, it is evident how much they depend on her security. She is seen, at times, attended by a numerous retinue, marching from cell to cell, plunging the

extremity of her body into each of them, and leaving in each an egg.

A day or two after this egg is deposited, the grub is excluded from the shell, having the shape of a maggot rolled up in a ring, and lying softly on a bed of a whitish-coloured jelly, on which it begins to feed. The common Bees then attend with astonishing tenderness and anxiety: they furnish it with food, and watch over it with unremitting assiduity. In about six days the grub arrives at its full growth, when its affectionate attendants shut up the mouth of its apartment with wax, in order to secure it from injury. Thus enclosed, it soon begins to line the walls of its cell with a silken tapestry, in which it undergoes its last transformation.

When it first crawls forth a winged insect, it is very weak and inactive; but, in the course of a few hours, it acquires strength enough to fly off to its labour. On its emerging from the cell, the officious Bees flock round it, and lick up its moisture with their tongues. One party bring honey for it to feed upon; and another is employed in cleansing the cell, and carrying out the filth, for the purpose of preparing it for a new inhabitant.

The neuter Bees in a hive amount to the number of 16,000 or 18,000. These are all armed with stings. The males are called *Drones:* they are unarmed, and are always killed by the neuters about the month of September.

Mr. Wildman, whose remarks on the management of Bees are well known, possessed a secret by which he could at any time cause a hive of Bees to swarm upon his head, shoulders, or body, in a most surprising manner. He has been seen to drink a glass of wine with the Bees all over his head and face more than an inch deep—several fell into the glass, but did not sting him. He could even act the part of a general with them, by marshalling them in battle

array upon a large table. There he divided them into regiments, battalions, and companies, according to military discipline, waiting only for his word of command. The moment he uttered the word *march!* they began to march in a very regular manner in rank and file, like soldiers. To these, his Lilliputians, he also taught so much politeness, that they never attempted to sting any of the numerous company which, at different times, resorted to admire this singular spectacle.

CARDING BEE*.

The Carding Bees nearly all perish in the winter; a few of the females only survive. These usually make their appearance early in the spring, as soon as the catkins of the willows are in blossom; upon which, at this time, they may commonly be seen collecting honey from the female, and pollen from the male catkins.

The neuters do not appear till the spring is somewhat advanced; and the males are most common in autumn, when the thistles are in blossom, upon the flowers of which they are abundant, sometimes appearing to be asleep, or torpid, and, at other times, acting as if they were intoxicated with the sweets they have been imbibing.

When these animals, of any sex, are walking on the ground, if a finger be moved to them, they lift up three legs on one side, by way of defence; which gives them a very grotesque appearance.

Their nests are usually formed in meadows and pastures, sometimes in groves and hedge-rows, where the soil is

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* Description. This Bee is yellow, with the hair of the thorax somewhat fawn-coloured.

Synonyms. Apis muscorum. *Linnæus.*—Bourdon des Mousses. *Latreille.*

entangled with roots; but now and then these are found in heaps of stones. When they do not meet with an accidental cavity ready made, they excavate one themselves with great labour. This they cover with a thick convex vault of moss, sometimes casing the interior surface with a kind of coarse wax to keep out the wet. At the lower part of the nest there is an opening for the inhabitants to go in and out at. This entrance is often through a long gallery, or covered way, a foot or upwards in length, by which the nest is more effectually concealed from observation.

The mode in which they transport the moss which they employ in the formation of their nest is singular. When they have discovered a parcel fitted to their purpose, and conveniently situated, they place themselves in a line, with their back turned towards the nest. The foremost lays hold of some with her jaws, and clears it, bit by bit, with her fore feet. When this is sufficiently disentangled, she drives it with her feet under her belly, and as far as possible beyond, to the second Bee. The second, in like manner, pushes it on to the third, and so on. Thus small heaps of prepared moss are conveyed to the nest by a file of four or five insects, where they are wrought and interwoven with the greatest dexterity by those that remain within.

The nests are often six or seven inches in diameter, and elevated to the height of four or five inches above the surface of the ground. When the covering of moss is taken up, an irregular comb presents itself, composed of an assemblage of oval bodies disposed one against the other. Sometimes there are two or three combs, placed on one another, but not united. These combs vary in size: they consist of a number of oblong or oval cells or coccoons, of a silky substance, fastened together, and spun by the larvæ when they are about to undergo their first change; for the Carding Bees do not form waxen cells for their young.

The cells are of three dimensions, answering to the three sexes. The void spaces between the cells are filled with masses of brown paste, made of gross wax, or pollen much wrought, and honey. Besides the masses, they attach to every comb, particularly the uppermost, three or four cells of the same coarse wax, in the shape of goblets, open at the top, which they fill with liquid and very sweet honey. —The first step towards furnishing a nest is to make a mass of the brown paste, and one of these honey-pots. The masses of paste are intended for the food of the larvæ, and in them the eggs are deposited. These vary in number, from three to thirty being to be found in one mass, but not all in the same cavity.

The larvæ are similar to those of the Hive Bee, but their sides are marked by irregular transverse black spots. After they are hatched, they separate from each other, eating the paste that surrounds them. The honey-pots may be intended to supply honey for the occasional moistening of the paste in making repairs, &c. The *pupa* in each cell is placed with its head downward, and makes its way out at the bottom of its coccoon.

The nests seldom contain more than fifty or sixty inhabitants; and in this community, both the females and males act in concert with the neuters in fitting up or repairing their habitations.—The nests of the Carding Bees are exposed to various depredators; but field-mice and polecats are their most formidable enemies.

THE ORANGE-TAILED BEE *.

The nest constructed by this Bee is of a very elegant appearance, being of an oval form, and composed of bits of

* Description. This is one of the largest of the British Bees; but it varies in size, being sometimes half an inch, and sometimes an

the larger mosses, closely and neatly compacted together. A small round hole or entrance is left on one side. These nests are about four inches in diameter on the exterior, and are generally formed on dry shady banks, in woods, lanes, or meadows. The food laid up for the larvæ consists of a kind of honey of a brownish colour, disposed in somewhat irregular masses or heaps; for these Bees do not form any regular cells or combs, like some of the others.

OF THE ANTS IN GENERAL.

All the species of Ants known in this country are gregarious; and, like the bees, consist of males, females, and neuters, of which the latter are alone the labourers. These build in the ground an oblong nest, in which there are various passages and apartments. In the formation of this nest every individual is occupied: some are employed in securing a firm and durable ground-work, by mixing the earth with a sort of glue produced in their bodies: others collect little bits of twigs to serve as rafters, which they place over their passages, to support the covering: others again lay pieces across these, and place on them rushes, weeds, and dried grass. The latter they secure so firmly, as completely to turn off the water from their magazines.

From the eggs of these insects proceed the larvæ, a small kind of maggots without legs, which soon transform into

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inch in length. Its body is black or dark brown, and hairy; and the extremity of the abdomen of a bright orange colour. The wings are light brown.

SYNONYMS. Apis lapidaria. *Linnæus.*—Red-tailed Bee. Great Orange-tailed Garden Bee. *Shaw's Nat. Mis.*—L'Abeille lapidaire. *Tigny.*—L'Abeille des Pierres. *Cuvier.*—Bourdon des Pierres. *Latreille.*

white chrysalids. The latter are generally called *Ants' eggs*, and are frequently used for the feeding of young pheasants, partridges, and nightingales.

The males are much smaller than the females, and seldom frequent the common habitation. All the labour which the females undergo is the laying of eggs; and the cold weather of winter always destroys them. The neuters, or labouring Ants, which alone are able to struggle through the winter, pass this season in a torpid state. The females and neuters are each armed with stings.

Ants frequently swarm on trees, where they have been supposed to do much injury. But this seems a very unjust charge against them; for in Switzerland they are even compelled to remain in the trees, in order to destroy the caterpillars. This is done by hanging a pouch full of Ants upon a tree, the root of which is smeared with wet clay or pitch, to prevent their escape: in consequence of this, they are soon compelled by hunger to seize upon and devour the caterpillars.

We are told that a very grateful acid is to be obtained from Ants by distillation; and we have one instance of a person being fond of eating them alive. As Mr. Consett was walking with a young gentleman in a wood near Gottenburgh in Sweden, he observed him sit down on an ant-hill, and with great apparent pleasure devour these insects, first nipping off their heads and wings. The flavour, according to his account, was an acid somewhat resembling, though much more agreeable than, that of lemon.

It is said that the Ants of *tropical climates* are never torpid; that they build their nests with a dexterity, lay up provisions, and submit to regulations, entirely unknown among those of Europe. They are, in every respect, a much more formidable race. Their stings produce insupportable pain, and their depredations do infinite mischief.

Sheep, hens, and even rats, by loitering too near their habitations, are often destroyed by them.

THE HORSE EMMET, OR GREAT HILL-ANT *.

It is chiefly near the old and decayed trunks of trees that the Hill-ants form their settlements. Their nest consists of a great number of apartments. In these they have their magazines, and bring forth and rear their offspring.

It is the peculiar habit of the Hill-ants to collect a vast quantity of pieces of dry sticks, chips, bits of straw, and other rubbish, which they carry to the surface of their colonies, and there place together in heaps, which sometimes become immensely large. This employment they renew every spring, and continue through the whole summer. It is not a little curious to observe from what distances they will bring, and with what dexterity they manage, sticks of an inch or two in length.

A gentleman of Cambridge one day remarked an Ant dragging along what, with respect to its strength, might be denominated a piece of timber. Others were severally employed, each in its own way. Presently this little creature came to an ascent, where the weight of the wood seemed for a while to overpower him: he did not remain long perplexed with it; for three or four others, observing his dilemma, came behind and pushed it up. As soon, however, as he had got it on level ground, they left it to his care, and went to their own work. The piece he was draw-

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* Description. This is a large species. The antennæ and head are blackish; and the thorax the same, but testaceous beneath. The abdomen is dark brown; and the legs are ferruginous. The wings are transparent, veined with black.

Synonyms. Formica Herculanea?? La Fourmi Hercule. *Tigny.*—Hill Ant. *Gould.*

ing happened to be considerably thicker at one end than the other. This soon threw the poor fellow into a fresh difficulty: he unluckily dragged it between two bits of wood. After several fruitless efforts, finding it would not go through, he adopted the only mode that even a reasoning being, in similar circumstances, could have taken; he came behind it, pulled it back again, and turned it on its edge; when, running again to the other end, it passed through without the least difficulty.

The same gentleman says that, sitting one day after dinner in the garden of his college, he was surprised by remarking a single Ant busily employed in some work that caused him to make many journies to and from the same place. This gentleman traced him to the entrance of the habitation of a community, from whence he observed him to take the dead body of an Ant in his fangs, and run away with it. He carried it to a certain distance, dropped it, and returned for another, which, by the time of his arrival, was brought to the same hole. This work was continued so long as the gentleman had time to remain near them.

The use of the before-mentioned collection of sticks and rubbish seems, in a great measure, to consist in aiding to guard the nests from foreign invasion. It seems also to be of use in promoting the maturity of the *pupæ;* numbers of which, in the summer time, may be found interspersed among the rubbish.

During the warm season of the year these Hill-ants bring up their maggots and *pupæ* nearly to the surface every morning; so that, from ten in the morning until about five in the afternoon, these may always be found lodged just under the surface of the ground. And if their mounts be examined about eight in the evening, the insects will be found to have carried them all down; but, if rainy weather be coming on, it will even be necessary to dig a foot or two deeper than usual to find them.

The Hill-Ants have a very odd and diverting propensity. One of them may frequently be observed in the act of running backward and forward with a fellow Ant in its mouth. This is not intended, as might be supposed, for prey; for it is soon after liberated, in a friendly manner, without having sustained any injury. This amusement, or whatever else it may be termed, is often repeated, these little creatures seeming fond of the sportive exercise.

THE RED ANT*.

The lodgments of this species are oftentimes formed under flat stones and rubbish; and not unfrequently in the forsaken habitations of moles. In the latter of these situations, the process of forming their nest is curious. They cut the earth into small parcels, and incrust these with the blades of grass. As the blades, towards the month of June (when this work is in progress) grow every day, so the Ants advance their labours in proportion. By this contrivance, in somewhat more than a month they have a number of little mounts, each about six inches high. The architecture is slight, and the demolition easy; but, without any serious accident, they last long enough to answer every purpose for which they were formed. The nests of those which reside under stones, pavements, in old walls, or under rubbish, do not require these out-works, and consequently the insects do not here form them, but are content with the covering they find.

In collecting their stores, these creatures may often be observed in full employment; one of them loaded with

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* DESCRIPTION. This species is considerably smaller than the last. Its general colour is red. The eyes, and a spot under the abdomen, are black.

SYNONYMS. Formica rubra. *Linn*..—La Fourmi rouge. *Cuvier*

a grain of wheat, another with a dead fly, and several together hauling along the body of some larger insect. Whenever they meet with any food too large to admit of being dragged away, they devour so much of it upon the spot, as to reduce it to a bulk sufficiently small for them to carry.

In all their excursions they have some object in view; and they seldom return to the nest without either themselves bearing something, or without news that something of use has been discovered, in which joint assistance is necessary. If information is brought that a piece of sugar, or bread, or any kind of fruit, has been discovered, even in the highest story of a house, they range themselves in a line, and follow their leader to the spot. Of this, the following is a remarkable instance, related by Dr. Franklin: Believing that these little creatures had some means of communicating their thoughts or desires to one another, he tried several experiments with them, all of which tended to confirm his opinion; but one seemed more conclusive than the rest. He put a little earthen pot, containing some treacle, into a closet, into which a number of Ants collected, and devoured the treacle very quickly. But, on observing this, he shook them out, and tied the pot with a string to a nail which he had fastened into the ceiling; so that it hung down by the string. A single Ant, by chance, remained in the pot: this Ant ate till it was satisfied; but when it wanted to get off, it could not, for some time, find a way out. It ran about the bottom of the pot, but in vain: at last it found, after many attempts, the way to the ceiling, by going along the string. After it was come there, it ran to the wall, and from thence to the ground. It had scarcely been away half an hour, when a great swarm of Ants came out, got up to the ceiling, and crept along the string into the pot, and began to eat again. This they continued to do

until the treacle was all devoured; in the mean time one swarm running down the string, and the other up.

THE SUGAR ANT*?

It is stated, that these ants, which took their name from the ruinous devastations which they committed on the sugar-cane, first made their appearance in Grenada about thirty years ago, on a sugar plantation at Petit Havre, a bay five or six miles from the town of St. George. From thence they continued to extend themselves on all sides, for several years; destroying in succession every sugar-plantation between St. George's and St. John's, a space of about twelve miles. At the same time colonies of them began to be observed in other parts of the island.

All attempts of the planters to put a stop to the ravages of these insects having been found ineffectual, an act was passed by the legislature, entitling the discoverer of any practicable method of destroying them, so as to permit the cultivation of the sugar-cane as formerly, to a reward of *twenty thousand pounds*, to be paid from the public treasury of the island.

Many were the candidates on this occasion, but very far were any of them from having a just claim to the reward. Considerable sums of money were, however, granted, in consideration of trouble and expences in making experiments.

The numbers of these Ants were incredible. The roads have been seen covered with them for miles together; and so crowded were they in many places, that the print of the horses' feet would appear for a moment or two, till

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* Description. The Sugar Ants are of a black colour, having their antennæ and mandibles rufous.

Synonym. Formica saccharivora. *Linnæus.*

filled up by the surrounding multitudes. All the other species of Ants, although numerous, were circumscribed, and confined to a spot, in proportion to the space occupied by the Sugar-ants, as small as a mole-hill to a mountain.

Their destruction was attempted chiefly by poison, and the application of fire.

Corrosive sublimate and arsenic, mixed with animal substances, was greedily devoured by them. Myriads were thus destroyed, and the more, as they were by these applications rendered so furious, as to destroy each other: yet it was found that these poisons could not be laid in sufficient quantities, even to give the hundred-thousandth part of them a taste.

The use of fire afforded a greater probability of success. When wood was burnt to the state of charcoal, without flame, and immediately taken from the fire, and laid in their way, they crowded to it in such astonishing numbers, as soon to extinguish it, although with the destruction of thousands. Holes were therefore dug at proper distances, and a fire made in each of them. Prodigious quantities perished in this way; for the places of those fires, when extinguished, appeared in the shape of mole-hills, from the numbers of dead bodies heaped on them. Nevertheless, the Ants appeared again as numerous as ever.

This calamity, which resisted so long the efforts of the planters, was at length removed by another, which, however ruinous to the other islands in the West Indies, and in some other respects, was to Grenada a great blessing, namely, the hurricane in 1780. Without this it is probable that the cultivation of the sugar-cane in the most valuable parts of that island, must have, in a great measure, been laid aside, at least for some time.

These Ants make their nests only under the roots of particular plants and trees, such as the sugar-cane, the lime, lemon, and orange trees, where they are protected

from the winds and rain; and the mischief done by them does not arise from their devouring those plants, but from these lodgments at their roots.

By the violence of the tempest, trees and plants (which commonly resist the ordinary winds) were torn out by the roots. The canes were universally twisted about, as if by a whirlwind, or torn out of the ground altogether; and a deluge of rain falling at the same time, the destruction of nearly the whole progeny appears to have been thereby effected.

THE YELLOW ANTS, AND BLACK ANTS, OF SOUTH AMERICA.

Dampier, speaking of the natural productions in the Spanish settlements of South America, says, that there were vast swarms of different kinds of Ants. Of these, the bite of the small Yellow Ants was most painful, their sting being like a spark of fire. They were so thick among the boughs in some places, that a person standing beneath, was sometimes almost covered with them before he was aware. These creatures have nests on great trees, placed on the body between the limbs: some of their nests are as big as a hogshead. This is their winter habitation; for in the wet season they all repair to these their cities, where they preserve their eggs.

"In the dry season, when they leave their nests, they swarm all over the woodlands; for they never trouble the savannahs: great paths, three or four inches broad, made by them, may be seen in the woods. They go out light, but bring home heavy loads on their backs, all of the same substance, and equal in size. I never (continues this celebrated voyager) observed any thing besides pieces of green leaves, so big, that I could scarcely see the insect for his burthen; yet they would march stoutly, and so

many were pressing forward, that it was a very pretty sight, for the path looked perfectly green with them.

"There was one sort of Ants of a black colour, tolerably large, with long legs. These would march in troops, as if they were busy in seeking somewhat; they were always in haste, and always followed their leaders, let them go where they would. They had no beaten paths to walk in, but rambled about like hunters. Sometimes a band of these Ants would happen to march through our huts, over our beds, or into our pavilions, nay, sometimes into our chests, and there ransack every part; and whereever the foremost went, the rest all came after. We never disturbed them, but gave them free liberty to search where they pleased; and they would all march off before night. They were so very numerous, that they would sometimes be two or three hours in passing, though they went very fast."

THE GREEN ANTS, BLACK ANTS, AND RED ANTS, OF NEW SOUTH WALES.

The following is an account of three different kinds of Ants that were observed in New South Wales, by the gentlemen who accompanied the expedition under Captain Cook:

"Some are (says the writer) as green as a leaf, and live upon trees, where they build their nests of various sizes, between that of a man's head and his fist. These nests are of a very curious structure: they are formed by bending down several of the leaves, each of which is as broad as a man's hand, and gluing the points of them together, so as to form a purse. The viscous matter used for this purpose, is an animal juice which nature has enabled them to elaborate. Their method of first bending down the leaves, we had no opportunity to observe; but we saw

thousands uniting all their strength to hold them in this position, while other busy multitudes were employed within, in applying this gluten, that was to prevent their returning back. To satisfy ourselves that the leaves were bent and held down by the effort of these diminutive artificers, we disturbed them in their work; and as soon as they were driven from their station, the leaves on which they were employed, sprang up with a force much greater than we could have thought them able to conquer by any combination of their strength. But, though we gratified our curiosity at their expence, the injury did not go unrevenged; for thousands immediately threw themselves upon us, and gave us intolerable pain with their stings, especially those which took possession of our necks and hair, from whence they were not easily driven. Their sting was scarcely less painful than that of a bee; but, unless it was repeated, the pain did not last more than a minute.

"Another sort are quite black, and their operations and manner of life are not less extraordinary. Their habitations are the inside of the branches of a tree, which they contrive to excavate, by working out the pith almost to the extremity of the slenderest twig; the tree at the same time flourishing, as if it had no such inmate. When we first found the tree, we gathered some of the branches, and were scarcely less astonished than we should have been, to find that we had profaned a consecrated grove, where every tree upon being wounded gave signs of life; for we were instantly covered with legions of these animals, swarming from every broken bough, and inflicting their stings with incessant violence.

"A third kind we found nested in the root of a plant, which grows on the bark of trees in the manner of misletoe, and which they had perforated for that use. This root is commonly as big as a large turnip, and sometimes

much bigger: when we cut it, we found it intersected by innumerable winding passages, all filled with these animals, by which, however, the vegetation of the plant did not appear to have suffered any injury. We never cut one of these roots that was not inhabited, though some were not bigger than a hazel nut. The animals themselves are red, and very small, not more than half as big as the common red Ant in England. They had stings, but scarcely force enough to make them felt: they had, however, a power of tormenting us in an equal, if not in a greater degree; for, the moment we handled the root, they swarmed from innumerable holes, and, running about those parts of the body that were uncovered, produced a titillation more intolerable than pain, except it is increased to great violence."

Dipterous Insects*.

OF THE OESTRI, OR GAD-FLIES†.

From the posterior part of the body of the Gad-flies, issues a wimble of wonderful structure. It is a scaly cylinder, composed of four tubes, which draw out like the pieces of a spying-glass. The last of these is armed with three hooks, and is the gimlet with which the insect bores through the tough hide of horned cattle, for the purpose of depositing there her egg. When this is hatched, the grub feeds on the matter issuing from the wound; and the nidus forms upon the body of cattle a lump, sometimes above an inch high. Some of the species deposit their eggs in the nostrils of sheep, and others, in places from which the larvæ, as soon as hatched, can be conveyed into the intestines of horses.

The larvæ are without feet, short, thick, soft, and annulate. When full grown, they let themselves fall to the earth, and generally pass their chrysalid state under cover of the first stone they meet with.

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* The Linnean order *Diptera,* comprises those insects that have only two wings, each furnished at its base with a poise or balancer.

† The mouth in the Oestri is merely a simple aperture. They have two feelers, but no beak. The antennæ are short, and consist of three articulations, the last of which is nearly globular, and furnished with a bristle on the fore-part: they are placed in two hollows on the front of the head. The face is broad, depressed, vesicular, and glaucous, and has been thought to have a distant resemblance to that of an ape.

[library stamp]

THE OX GAD-FLY*.

The eggs of the present species are deposited in the back of the ox; and the larva lives beneath the skin, between this and the cellular membrane. Its sac or abscess is somewhat larger than the insect, and, by narrowing upwards, it opens externally to the air by a small aperture.

The larva is smooth, white, and transparent, when young; but, when full grown, is of a deep brown. It is also supplied in this state with innumerable minute hooks, ranged in contrary directions on its body; with which, by occasionally erecting or depressing them, it is moved about in the abscess; and from this motion, and the consequent irritation, a greater or less copious secretion of pus takes place for its sustenance.

When the larva is full grown, it effects its escape from the abscess, by pressing against the external opening. When this becomes of sufficient size, it writhes itself through, and falls from the back of the animal to the ground; and, seeking a convenient retreat, becomes a chrysalis. After the exit of the larva, the wound in the skin is generally closed up and healed in a few days.

The Ox Gad-fly is the largest of the European species, and is very beautiful. When the perfect insect leaves the chrysalis, it forces open a very remarkable marginated

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* DESCRIPTION. This insect has brown unspotted wings, and the abdomen is marked with a black band in the middle, and has dusky yellow hairs at the tip. The front is white, and covered with down; and the thorax is yellowish before, black in the middle, and cinereous behind. The female differs from the male, in having a black style at the extremity of the abdomen.

SYNONYMS. Oestrus bovis. *Linn.*—Larvæ called *Bots*, *Wormuls*, *Wornuls*, or *Warbles*.—L'Oestre des Bœuf. *Latreille.*

triangular lid, which is situated on one side of the small end.

The pain it inflicts in depositing its egg, is supposed to be very severe, since, whenever an ox or cow is attacked by this fly, it is easily known by the extreme terror and agitation of the whole herd. The unfortunate object of attack, runs bellowing from among them to some distant part of the heath, or the nearest water, while its tail, from the severity of the pain, is held with a tremulous motion straight from the body, in the direction of the spine, and the head and neck are also stretched out to their utmost length. The rest, from fear, generally follow to the water, or disperse to different parts of the field.

Such is the dread that cattle have of these flies, that, when one of them has met a herd in their way home from the labour of the day, they have been known to turn back in the utmost affright, regardless entirely of the stones, sticks, and noise of their drivers; and to proceed, without stopping, to some retreat in the water, where they could be secure from its attacks. All flies of this tribe have such a dislike to water, as never to follow them there.

When oxen are yoked to the plough, the attack of this fly is attended with real danger, as they become perfectly uncontrollable, and will often run with the plough directly forward, even through the hedges of the field. To many ploughs there is, on this account, a contrivance to set them at liberty the moment they are alarmed.

The female fly is very quick in her operation of depositing the egg; she does not remain on the back of the animal more than a few seconds.—The larvæ of this insect are known among the common people, by the name of *Wornuls*, *Wormuls*, *Warbles*, or *Bots*.

THE TANJORE MAHARAJA SERFOGI'S SARASWATI MAHAL.

THE HORSE GAD-FLY*.

The larvæ of this fly are those odd-looking grubs which are commonly found in the stomach of horses, and sometimes, though much less frequently, in the intestines. Here they hang in clusters of from half a dozen to more than a hundred, adhering to the inner membrane of the stomach, by means of two small hooks or tentacula at their heads, whose points turn outward.

When they are removed from the stomach, they will attach themselves to any loose membrane, even to the skin of the hand. To do this, they draw back their hooks, which have a joint near their base, almost entirely within their skin, till the two points come close to each other; then, keeping them parallel, they pierce through the membrane, and immediately afterwards expand in a lateral direction, and by these means the insects become perfectly fixed.

Their food is probably the chyle, that white juice which is formed in the stomach by the digestion of the food, and which is afterwards converted into blood. This they suck in at a small longitudinal aperture, situated between the hooks.

From their slowness of growth, and the very small quantity of food they require, it has been found extremely

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* Description. This Gad-fly is distinguished from the rest of its tribe, by having a black band in the middle, and two dots at the tip of its whitish wings. The abdomen is yellow brown, with black spots at the divisions of the segments. The female is more brown than the male, and has her abdomen elongated with a cleft terminal style.

Synonyms. Oestrus equi. *Linn.*—L'Oestre du fondement des Chevaux, in France.

difficult to destroy them by any medicine or poison that could be thrown into the stomach. They are, however, not now considered so injurious to horses as they formerly were, and therefore the difficulty of their extirpation seems not a matter of so much consequence as people have imagined.

The mode pursued by the parent fly to obtain for its young a situation in the stomach of the horse, is singular: —The female, when the time for laying her eggs is at hand, approaches on wing that part of the horse where she intends to deposit the egg, with her body nearly upright, and her tail, which is lengthened out for the purpose, bent inwards: she scarcely appears to settle, but merely touches the hair, with the egg held out on the projected point of the abdomen. The egg adheres by means of a glutinous liquor secreted with it. She then leaves the horse, goes to a small distance, and prepares a second egg; then, poising herself before the part, deposits this in the same way. The liquor dries, and the egg becomes firmly glued to the hair: this is repeated by various flies, till 400 or 500 eggs are sometimes laid on one horse.

The inside of the knee is the part on which these flies principally deposit their eggs; and next to this they fix them on the sides, and the back part of the shoulder: but almost always in places that are liable to be licked by the tongue. When these eggs have remained on the hairs four or five days, they become ripe, after which the slightest application of warmth and moisture is sufficient to bring them into life. If at this time the tongue of the horse touches the egg, its lid is thrown open, and a small active worm is produced, which readily adheres to the surface of the tongue, and is from thence conveyed with the food to the stomach.

It is, however, fortunate for the horses, that this insect

is exposed to so many hazards, that scarcely one in a hundred arrives at the perfect state of a fly. The eggs, when ripe, often hatch of themselves, and the larvæ crawl about till they die; others are washed off by the water. When in the mouth of the animal, they have to undergo the ordeal of the teeth and mastication; and many pass entirely through the intestines with the food. When the larvæ arrive at full growth, and are voided along with the dung, many are either dropped into mud or water, others are crushed to death by being trod upon, and others are picked up and devoured by birds. The perfect fly is very tender, and but ill sustains the changes of weather; and cold and moisture, in any considerable degree, are probably often fatal to it.

THE SHEEP GAD-FLY *.

The manner in which the Gad-fly of the sheep deposits its egg, has been seldom noticed; nor is it easy, from the obscure and rapid motion of this insect, to discern the exact manner in which this is accomplished. The moment the flies touch the noses of the sheep, they shake their heads, and strike the ground violently with their fore-feet: at the same time holding their noses to the earth, they run away, looking about them on every side, to see if the flies pursue. They also appear to smell the grass as they go, lest these insscts should be lying in wait for them. If they observe one, they gallop back, or take some other direction. As they cannot, like the horses, take refuge in the water, they have recourse to a rut, or dry dusty road,

* Description. The abdomen is spotted with black and white; and the head is white and punctured. The eyes are marbled; and the wings are pellucid, and punctured at the base.

Synonyms. Oestrus ovis. *Linn.*—L'Oestre des Moutons. *Latreille.*

where they crowd together during the heat of the day, with their noses held close to the ground. This renders it difficult for the fly conveniently to get at the nostril. It is most probably from repeated attacks, and the consequent rubbing against the ground, that the nostril becomes highly inflamed and sore, and occasions their touch to be so much dreaded by the sheep.

*OF THE TIPULÆ OR CRANE-FLIES**.

In their general form, these insects have a great resemblance to the gnats, but they are easily distinguished from them, by their expanded wings, and their want of the long proboscis which is so conspicuous in the gnats.—From the commencement of spring until the beginning of autumn, the larger kinds of Tipulæ are to be seen in great abundance in pastures and meadows. Some of the species lay their eggs upon the ground amongst the grass, and others in the hollows of decayed trees. The *larvæ* are without feet, soft, and cylindrical.

Both the *larvæ* and *chrysalids* of the smaller Tipulæ are found in water, and are very various both in size and colour. Some, like the polypus, are furnished with a pair of arms; and others are enclosed in cylindrical tubes, open at the ends. The latter swim nimbly, but the others always remain in the holes which they have formed in the banks of rivulets. Some of the species spin a silken case round part of their body. Their whole frame is, in general, so very tender, that a touch alone is often sufficient to crush them.

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* The Tipulæ have a very short membranaceous proboscis, the back of which is grooved, and receives a bristle. The feelers are two, incurved, thread-shaped, and longer than the head; and the antennæ are, for the most part, filiform.

THE MEADOW CRANE-FLY, OR LONG-LEGS*.

In grass lands and clover stubbles, the grubs or larvæ of these flies are oftentimes extremely injurious; and even crops of grain, in the vicinity of meadows, are occasionally much damaged by them. They feed on the roots of plants, and destroy the tender shoots at the time they are beginning to make their appearance above the surface of the ground.

It is about the middle of August that the females usually commence the operation of depositing their eggs. In this act they bend their tails to the roots of the grass, and move about from place to place, leaving a few eggs in each spot where they alight. The body of each female contains several hundred eggs; and, upon being squeezed, these will quit the tail one by one, with a sudden spring. If the weather be fine, nearly the whole of the eggs are deposited by the end of the first week in September. The *larvæ* or grubs usually begin to quit the eggs some time in the month of February, and they continue in this state during the whole of the summer.

In the day time the larvæ are generelly to be found at the depth of from half an inch, to an inch and a half, below the surface of the ground. It is supposed that they do not come much above-ground, even in the night, but that they feed chiefly below the surface.

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* Description. This insect is eight or nine lines in length. Its body is of a cinereous brown colour. The antennæ in both sexes are filiform. The wings are transparent, and brown on their exterior margin.

Synonyms. Tipula oleracea. *Linnæus.*—La Tipule des Près. *Tigny.*—The larva, among farmers, has the general name of "*the grub.*"

These insects are destroyed in great numbers by rooks, jackdaws, starlings, lapwings, and other birds.

About the beginning of August they assume their *pupa* state, and before the end of that month become winged insects.

In an excellent paper communicated to the Holderness Agricultural Society, by Mr. Stickney, of Ridgemont, it is stated that, in the destruction of these pernicious insects, lime has not, as hath usually been supposed, any material effect. Nor does this gentleman conceive, that any other substance can be applied to the soil, on a large scale, which will destroy them.

THE WHEAT-FLY *.

In July, 1795, Mr. Marsham had been informed, that an insect had made its appearance among the wheat of a gentleman, a friend of his, in Hertfordshire, which threatened much mischief. Some of the ears were brought to him for examination; and, on opening those that seemed diseased, he found in many an orange-coloured powder, and in several, one or two very minute larvæ of a yellow colour. On applying a magnifier, for they were too minute for examination with the naked eye, he supposed them at that time to be the larvæ of a small species of Musca; but they have since been discovered to belong to this tribe. They were thicker at one end than the other; extended and contracted themselves at pleasure; and had, in addition, a leaping motion, frequently springing full half an inch from the paper on which he examined them.

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* Description. The Wheat-fly is about the twelfth of an inch in length. Its body and legs are of a dull yellow colour, and the wings are whitish, with a fringed margin.

Synonym. Tipula Tritici. *Linn. Tran.*

The ears of wheat were put into water, with gauze tied round them; but, notwithstanding this care, the flies escaped, after their development, without being seen. Mr. Marsham wrote to several friends, requesting their attention to this subject; in consequence of which, an accurate investigation was immediately set on foot.

It appears that these larvæ take their station in the longitudinal furrow of the grain, to the bottom of which they seem attached. Here probably sucking the milky juice which swells the grain, and thus depriving it of part, and in some cases, perhaps, of the whole of its moisture, they occasion it to shrink up, and become what the farmers call *pungled.* They infect several grains in the same ear, and some ears have been observed in which even a fourth of the grain was either destroyed, or very materially injured by them. The late-sown wheat always appeared the most infected, arising, no doubt, from the seed of that sown earlier obtaining too great a degree of hardness, before the insects come out, to be liable to be much hurt by them.

The Rev. Mr. Kirby attended closely to these insects; but it was some time before he was able to discover the parent flies, and still longer before he could find them in sufficient numbers, to allow him to make the necessary observations as to their habits and economy.

In the beginning of June, 1798, however, he chanced to walk through a corn-field in the evening, and, to his great surprise, observed an innumerable multitude of them flying about in every direction; and, for nearly a month afterwards, found them in the greatest abundance. They were seldom seen before seven o'clock; at eight the fields appeared to swarm with them, at which hour they were all busily engaged in laying their eggs; and about nine they generally disappeared. They were so extremely numerous, that if each of them were to lay its eggs in a different

floret, and these eggs were permitted to produce larvæ, more than half the grain of the adjacent country would infallibly be destroyed. Twelve have been observed at the same moment laying their eggs in the same ear: but among all these myriads not one male could be discovered. During the day-time none of these insects are to be seen, as they then continue lodged in a state of repose upon the lower part of the culm. Upon shaking the stalks, however, they will fly about.

The female lays her eggs by means of a long, retractile tube, which unsheaths an aculeus as fine as a hair, and very long.

These insects would soon become of serious injury to mankind, were not their race kept within due bounds by several natural enemies, some of which devour them, and others *(Ichneumon Tipulæ)* deposit their eggs in the larvæ, the young of which, when hatched there, find a proper nourishment in the bodies of their hosts.

This ichneumon is about the size of a wheat-fly: and in order to observe the manner of the female's depositing her eggs in the caterpillars of the wheat-fly, Mr. Kirby placed a number of the latter on a sheet of white paper, and then set an ichneumon down in the midst of them. She soon discovered one of the larvæ; when, vibrating her antennæ in an intense degree, she fixed herself upon it, and, bending her abdomen obliquely under her breast, inserted her aculeus into the body of her victim, (which seemed by its motion to experience a momentary pain,) and there deposited a single egg. This being done, she went to a second, which was constrained to undergo the like operation, and so on to all the rest. She never deposited more than one egg in each larva; and when she was remarked to mount one that had been pricked before, she soon discovered her mistake and left it.

The size of the two insects is so nearly alike, that one

young only can be nourished by a single larva; and therefore instinct teaches the parent ichneumons to deposit only this number in each.

*OF THE FLIES IN GENERAL**.

The appellation of Fly has been given almost exclusively to these insects, probably from their being so much more common than any others. The larvæ of some of the species live in water; others are found on trees, where they devour the plant-lice; and others in putrid flesh, cheese, &c. Most of the flies are torpid during the winter, and therefore lay up no provision for their nourishment in the cold season.—At the decline of the year, when the mornings and evenings become chilly, many of the species come for warmth into houses, and swarm in the windows. At first they appear very brisk and alert; but as they grow torpid they seem to move with difficulty, and at last are scarcely able to lift their legs, which seem as if glued to the glass; and by degrees many do actually stick on till they die in the place. It has been observed that some of the flies, besides their sharp, hooked nails, have also skinny palms or flaps to their feet, whereby they are enabled to stick on glass and other smooth bodies, and to walk on ceilings with their backs downward, by means of the pressure of the atmosphere on those flaps; the weight of which they easily overcome in warm weather, when they are brisk and alert. But towards the end of the year this resistance becomes too mighty for their diminished strength; and we see flies labouring along, and lugging their feet on windows as if they stuck fast to the glass; and it is with the utmost difficulty they can draw one foot after

* The mouth of the insects of this tribe has a soft, fleshy proboscis, with two equal lips; and the sucker is furnished with bristles. The antennæ are generally very short.

another, and disengage their hollow caps from the slippery surface. On a principle exactly similar to this it is that boys, by way of amusement, carry heavy weights, by only a piece of wet leather at the end of a string, clapped close to the surface of a stone.

It is a very extraordinary fact, that flies have been known to remain immersed in strong liquors, even for several months, and afterward, on being taken out, and exposed to the air, have again revived. Some, we are told by Dr. Franklin, were drowned in Madeira wine, when bottled in Virginia to be sent to England. At the opening of a bottle of this wine at a friend's house in London, many months afterwards, three drowned flies fell into the first glass that was filled. The Doctor says, that, having heard it remarked that drowned flies were capable of being revived by the rays of the sun, he now proposed making the experiment. They were therefore exposed to the sun, upon the sieve which had been employed to strain them from the wine. In less than three hours two of them began, by degrees, to have life. They commenced this by some convulsive motions in the thighs; and at length they raised themselves upon their legs, wiped their eyes with their fore-feet, and, soon afterwards, flew away.—The Rev. Mr. Kirby informs me that he has made the same observation on flies taken out of home-made wines. He says that many have recovered after having been twelve months immersed.

THE COMMON FLESH-FLY *.

It is a fact not generally known, that this is a viviparous insect, depositing its offspring, in a living state, on the

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* Description. This insect, in appearance, is much allied to the large Blue-bottle flesh-fly †. It is, however, somewhat more slender, and is besides of a grayish tint, occasioned by some irregular

† Musca vomitoria. *Linn.*

meat in our shambles and larders. These young ones appear under the same worm-like form as the grubs produced from the Blue flesh-fly. They feed as those do, increase in size, undergo all their transformations in the same manner, and even in the fly-state appear but little different. It appears that the eggs of this fly are extruded from the uterus into the cavity of the abdomen, and there undergo their first change, differing in this respect from most others of the insect tribes.

When the larvæ have attained their full size (which is generally in seven or eight days) they quit their food, and wander in search of loose earth or rubbish, in which they bury themselves and undergo their metamorphoses.

Some others of the flies are also viviparous.

THE HESSIAN FLY*?

Among the various causes of alarm experienced by the farmer in the course of his rural labours, few are more powerful, though many more justly so, than the larvæ or grubs of this little fly. These are lodged and nourished in the

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and rather long stripes on the corselet running lengthwise, and some still more irregular marks of the same kind on the body; all of them of a cinereous gray, separated by a shining brown, which, under certain points of view, appear of a bluish tint. Its legs are black, and the halteres or balancers under its wings are whitish, and its reticular eyes are somewhat red.

Synonyms.. Musca carnaria. *Linn.*—La Mouche carnassiere, in France.—La Mouche vivipare. *Cuvier.*

* Description. This fly is not quite the fourth part of an inch in length. Its thorax is dark-coloured, but marked longitudinally with two yellow lines. The grubs are white, about two lines in length, composed of ten rings, with the head pointed at the end. The chrysalis is yellow, shining, rather more than one line long, and composed of rings.

Synonym. Musca Pumilionis. *Linn.*

very heart of the stems of wheat and rye, just above the root, which they entirely destroy.

In order to determine the species of this animal, Mr. Markwick planted some diseased roots of wheat in a small flower-pot filled with bran: this pot he covered over with gauze, in such a manner that no insect could get in from the outside, nor could any escape from within. Not very long afterwards he discovered three small flies, which he found to be of this species, sitting on the inside of the gauze, and, a few days afterwards, three more. There were in the pot six roots of diseased wheat, which thus produced six flies. On examining the roots, he now found an empty chrysalis in each.

The principal stems of the corn being entirely destroyed by this grub, gave the crop of wheat belonging to a friend of Mr. Markwick so disastrous an appearance, that scarcely a hope was entertained of any produce: but after the grub had changed into its chrysalis state, the mischief ceased, and none of the roots were so materially injured as to prevent them throwing out shoots on each side. At harvest-time it was a matter of most agreeable surprise that this should prove a good crop of wheat, with the ears throughout the field large and well filled. The owner even thought it the best crop on his farm, and conjectured that it would produce about three quarters and a half of threshed corn from each acre.

The wheat that was sown early, about the beginning of October, was alone affected by this insect. The reason was, probably, that the cold at the approach of winter had destroyed all the flies before the late-sown wheat had time to spring out of the ground: consequently their eggs could not be laid in this. The fly appears to be perfected in May, or the beginning of June.

It was conjectured that this was the *Hessian Fly*, whose depredations in America have been so notorious. If this is

the case, Mr. M. is of opinion that a little good English husbandry, by keeping the ground in heart, and thus enabling the wounded shoots to repair themselves by strong lateral ones, will prevent any serious alarms.

THE CHEESE-FLY *.

The larvæ of these Flies are the troublesome maggots found in cheese, so well known to housewives under the name of *Hoppers*. They proceed from the eggs deposited in the crevices or holes of the cheese by the parent fly.

This maggot is surprisingly strong and vigorous, and leaps to a considerable distance when disturbed. To do this it erects itself on its tail, and, bending its head into a circle, fixes two black claws, which are situated at the end of the tail, into two cavities formed for their reception at the back of the head. It then exerts its muscular powers, and, in suddenly extending its body, throws itself, for its size, to a vast distance. One of these insects, which was not the fourth of an inch long, has been known to leap thus out of a box six inches deep, or to twenty-four times its own length.

The rottenness of cheese is in a great measure occasioned by these little maggots; for they crumble the substance of it into small particles, and the smallest tainted spot immediately spreads when any of them get upon it.

When they are about to change into chrysalids, they desert the cheese, and in three or four days afterward grow stiff and lifeless. The fly bursts through an opening in the skin just at the head, which there divides into two parts. At its first appearance the wings are not fully

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* DESCRIPTION. The Cheese-fly is a small and dark-coloured insect, with white wings, each of which has a black rib.

SYNONYMS. Musca putris. *Linn.*—Larvæ called *Hoppers*.

formed, but it is able to run about with great activity: the wings expand by degrees, and in the course of a quarter of an hour they are perfected.

In the ovary of a single female no fewer than two hundred and fifty-six eggs have been found.

THE CHAMÆLEON FLY *.

This is one of our most common two-winged insects. The egg from which it is produced is deposited by the female in the hollow stalks of reeds and other aquatic plants. From this proceeds a larva of singular structure, which is often to be seen crawling on grass and plants near shallow standing waters, or floating near the surface.

The general colour of the larvæ is a greenish brown. Their bodies consist of eleven rings, and their skin somewhat resembles parchment. Though these animals, before their transformation into flies, live in water, air is necessary to support their principle of life; and the apparatus with which nature has furnished them for that important purpose deserves our particular notice. The last ring or termination of their bodies is open, and serves as a conductor of air. From this ring proceed a number of hairs, which, when examined by the microscope, are found to be real feathers with regular vanes. In particular situations the larvæ bend the last ring in such a manner as to reach the surface of the water or mud in which they are placed. The feathers prevent the water from entering the tube or organ

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* DESCRIPTION. The general colour of the Chameleon Fly is black. The scutellum is two-toothed and yellow. On each side of the abdomen there are three triangular yellow spots, and one at the end.

SYNONYMS. Musca chamæleon. *Linnæus*.—La grande Mouche armée. *Cuvier*.

of respiration; and, when the animal raises the termination of its body to the surface, in order to receive air, it erects and spreads the feathers, and by these means exposes the end of the tube to the atmosphere. When it wishes to descend, it contracts the filaments into the form of a ball, and the bubble of air contained within it serves to keep the body in a vertical position.

If this insect be cautiously cut open, two large vessels, or tracheæ, will be seen on each side to occupy almost one half of the body. Both of these terminate in the open tube, or last ring.

The head of this creature exhibits not less matter of curiosity than its tail. In the middle part of its mouth is placed a hard, pointed, horny substance, immovable, and somewhat resembling the upper mandible in the beak of a bird. On each side of this there is a small and very singular kind of process. These have lately been discovered to be the feet, or, perhaps more properly, the arms, by which the animal performs many of its movements in the water, and by the aid of which only it can move itself forward on dry land. Another principal use of these members seems to be to loosen the mud, for the purpose of allowing the mouth to have a free access to it; performing, in some measure, the same functions in this respect as the gristle in the nose of a hog. The animal has the power of drawing these organs inward at pleasure, so as to hide them as it were within the cheeks; and from this peculiar position some persons have said that this larva carries its feet in its mouth.

It is a calm, inoffensive animal; discovers no symptoms of fear when man approaches, and performs in his presence all its usual operations with great tranquillity.

When the time of its metamorphosis approaches, it leaves the water, and, climbing up the side of the bank, chooses a place where it can lie only in part immerged in

water. Here it remains at rest, until it finally attains its chrysalid state. From five to ten days are occupied in attaining its complete form, and becoming a fly. This change always takes place about the middle of July.

THE RAT-TAILED WORM FLY *.

The larvæ of the present species are usually found in moist places, such as are frequented by the common black or warty lizard; and they never appear on dry ground till about to undergo their first transformation. In this state they somewhat resemble a tadpole in form, the fore-part being soft, thick, and rounded, and the tail small and tapering. They are covered with a viscous fluid, and on that account are generally found encrusted with a coat of dirt. This seems to be their colour till they are washed, when they are found of a transparent white.

The parent fly always lays her eggs in some place near the vicinity of water; that is, where it is betwixt moist and dry. M. Reaumur watched the motions of one of these insects, which he saw flying about a bucket of water that stood in his garden. After crossing it often, she at length descended within its mouth, and then, flying round and round it several times, stopped about an inch above the surface of the water, and laid, in several places, a little cluster of eggs. These were all deposited where the wood was just damp from the influence of the water below, and invariably in cavities between two adjoining staves, where

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* DESCRIPTION. The body is downy; and the thorax black, with four yellow lines. The abdomen is yellow, with transverse black lines, connected by a longitudinal stripe.

SYNONYMS. Musca pendula. *Linn.*—The larva is called by Reaumur *Queue de rat.*

the water was less likely to be dried up than elsewhere. In this situation, the young insect was no sooner extruded from the egg, than it found itself within the reach of the element where it was destined to pass the most considerable part of its life.

The young ones are no sooner dropped into the water, than, like all other animals in their natural element, they find themselves endowed with the instinct of searching for their own food, and of employing, in an appropriate manner, all the members of their body to the uses for which they are naturally adapted.

The tail of this insect, like that of the last, is its organ of respiration; and though, like the whale, it is an inhabitant of the water, yet, like that, it is a breathing animal, and would be entirely suffocated were it to be continued under water and excluded from access to the air.

Reaumur, in order to observe the economy of these little creatures, which he denominated *Rat-tailed Worms*, collected a number of them, which he put into a glass vessel filled two inches high with water. At first they were considerably agitated, each apparently searching for a proper place of repose. Some of them swam across, others attached themselves to the sides, and others rested at the bottom of the vessel. In a quarter of an hour they were almost all tranquil, and Reaumur soon discovered the real use of their long tails. On examining the vessel, he found that each of the animals, in whatever situation they were placed, extended its tail exactly to the surface; that, like other aquatic insects, the respiration of air was necessary to their existence; and that the tail, which is tubular, and open at the extremity, was the organ by which this operation was performed. In this experiment, the distance from the bottom to the surface was two inches, and, of course, the tails were of an equal length. To discover how far the animals could extend their tails, this most ingenious and

indefatigable philosopher gradually augmented the height of the water, and the tails uniformly rose to the surface till it was between five and six inches high. When the water was raised higher, the animals immediately quitted their station at the bottom, and either mounted higher in the water, or fixed themselves upon the sides of the vessel, in situations which rendered it convenient for them to reach the surface with the points of their tails.—These tails consist of two tubes, each of which is capable of extension and contraction. The first tube is always visible; but the second, which is the proper organ of respiration, is exerted only when the water is raised beyond a certain height. Through this tube the air is conveyed into two large tracheæ, or wind-pipes, within the body of the animal, and thus maintains the principle of life. When the tails are below the surface, the animals occasionally emit small bubbles of air, which are visible to the naked eye, and immediately afterwards they repair to the surface for fresh supplies.

So anxious is nature to provide animals, in every state of their existence, with air, that, after the transformation of many insects into chrysalids, she creates instruments for that purpose which did not exist previously to their transformation. These Rat-tailed worms, soon after they are transformed into chrysalids, instead of a soft pliable skin, are covered with a hard crustaceous substance, seemingly impervious to the air; and the tail, which was the wind-pipe of the animal in its first state, gradually vanishes. In a few hours, four hollow horns shoot out, two from the fore and two from the under part of what was the head of the animal. These horns, which are hard and tubular, M. de Reaumur discovered to be real wind-pipes, destined for the introduction of air into the chrysalis. He likewise discovered that these horns, which had pierced the hard exterior covering, terminated in as many tracheæ within

the body of the animal. This fact affords a strong example of the necessity of air for sustaining the principle of life, even in its lowest condition. After these animals pass from the chrysalid state to that of flies, they are deprived both of their tails and horns. But nature, in this last stage of their existence, has not left them without proper resources for the introduction of air into their bodies. Instead of protuberant tracheæ, in the form of tails or horns, they now, like other flies, receive air by means of stigmata or holes, variously disposed over different parts of the body.

These Rat-tailed Worms pass the first and longest part of their lives, which is supposed to be several months, under water. When near the time of their transformation, they leave that element, retire into the ground, and there become chrysalids. From this state they are changed into flies, and pass the remainder of their existence in the air.

OF THE TABANUS OR *WHAME-FLY TRIBE**.

The insects of the present tribe subsist on the blood of animals, which they suck by means of their proboscis, with great avidity. They are chiefly active during the hottest weather of summer. In most of the species the eyes are beautifully coloured. Wet meadows and moist woods are the places in which they principally abound. The *larvæ* of, at least, some of the species live underground.

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* The mouth is furnished with a straight, exserted, membranaceous proboscis, which terminates in an ovate knob, and two equal lips. The sucker projects, and is placed in a groove at the back of the proboscis, with a single valved sheath and five bristles. There are two equal palpi or feelers, which are clavate, and which terminate in a point. The antennæ are short, approximated, and have an elevated tooth at the base.

THE HORSE-FLY *, AND GREEN-EYED WHAME-FLY †.

The puncture of both these insects is extremely keen and painful. During the summer-time, the former torment horses and cattle in such manner as sometimes to throw them into a state of the utmost alarm and agitation. They are more abundant in wet weadows and pastures than in other places. Mankind are also not unfrequently attacked by them.

The *Green-eyed* species likewise torment mankind. Those who have walked in shady lanes and in woods, during the hot weather of June and July, know well what it is to suffer from their attacks. They conceal themselves in the crevices of the bark of trees, or among the foliage, until about noon, from which time until five or six o'clock in the evening, they are oftentimes very troublesome. Both species delight in the hottest sunshine, and indeed seldom fly abroad except in fine weather.

In these insects, as in the Gnats, it is to be remarked that the females only are troublesome. The males are found on flowers, from which they appear to derive their whole nourishment. The latter, towards the close of the day, are

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* Description. The length of this insect is about eleven lines. The eyes are of a greenish brown colour; and the back of the abdomen is marked with white triangular spots.

Synonyms. Tabanus bovinus. *Linn.*—Le Taon des Bœufs. *Tigny. Cuvier.*

† Description. The length is about five lines. The head is yellowish, with three black shining dots, forming a triangle on its anterior part. The eyes are of a brilliant yellowish green, with some black specks.

Synonyms. Tabanus cæcutiens. *Linn.*—Le Taon aveuglant. *Tigny.*—Le Taon aveugle. *Cuvier.*

frequently observed to fly round and round in the air, apparently for the purpose of inviting the females.

De Geer was the first naturalist who described the larvæ of this tribe of insects. Those of the Horse-fly, as he states, live under the surface of the earth. They are of a yellowish white colour, and destitute of feet, but furnished with a series of fleshy tubercles, which supply the place of feet. Their body is cylindrical, and terminates before in a conical point. The head is small and scaly, furnished with two large hooks, by means of which it is supposed they are enabled to dig their holes in the ground.

They change into *pupæ* in the earth. After continuing in this state about a month, they break out from their shell, through a longitudinal orifice which they make in the upper part of the thorax, and become perfect insects.

OF THE GNATS IN GENERAL.

These insects principally frequent woods and watery places, and, in many parts, are known to the country people by the name of *Midges*. They live by sucking the blood and juices of the larger animals.

Their *larvæ* are very common in stagnant waters. The bodies of these are composed of nine segments, the last of which is furnished with a small cylindrical tube through which they breathe, frequently rising to the surface of the water for that purpose.—The head of the *chrysalis* is bent down towards the breast, so as to throw the thorax in front; in this the respiratory tubes are situate, near the head. The last segment of the abdomen terminates in a

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* The mouth of the Gnats has a long, slender trunk, or flexile sheath, including five pointed bristles; it has also two feelers. The antennæ are generally thread-shaped, but those of some of the males are feathered.

kind of flat fin, by means of which the creature performs all its motions in the water.

THE COMMON GNAT*.

Few insects are better known than this species of Gnat, and there are not many that afford a more interesting history.

From the beginning of May their larvæ may be seen in stagnant waters, with their heads downward, and the extremity of their abdomen at the surface; from the side of this arises the hollow tube through which they respire. Their heads are armed with hooks, that serve to seize on insects and bits of grass, on which they feed; and on their sides are four small fins, by the help of which they swim and crawl along. These larvæ retain their form during a fortnight or three weeks, after which they turn into chrysalids; and all the parts of the winged insect are now distinguishable through their thin exterior covering. The place and shape of their respiratory tube are also altered: this is now divided into two parts, and is situated near the head. The chrysalids abstain from eating, and reside almost constantly at the surface of the water; but, on the least motion, they may be seen to unroll themselves from their spiral position, and, by means of little paddles on their hinder part, to plunge to the bottom. In the course of a few days they are transformed into perfect Gnats. The chrysalids swell at the head, and the flies burst from their enclosure. If at the instant of the change a breeze springs up, it proves to them a dreadful hurricane, as the water gets into their case, from which they are not

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* SYNONYMS. Culex pipiens. *Linnæus*.—Le Cousin commun. *Cuvier*.

yet perfectly loosened; this immediately sinks, and they are drowned.

The female deposits her eggs on the surface of the water, and surrounds them with a kind of unctuous matter, which prevents them from sinking; and she at the same time fastens them with a thread to the bottom, to prevent them from floating away, at the mercy of every breeze, from a place the warmth of which is proper for their production, to any other where the water may be too cold, or the animals, their enemies, too numerous. In this state they therefore resemble a buoy that is fixed by an anchor. As they come to maturity they sink deeper; and at last, when they leave the egg, they creep, in the form of grubs, at the bottom.

If the Gnats were not devoured by fish, water-fowl, swallows, and other animals, the air would often, from their immense multitudes, become darkened: a few instances have occurred in which this has been the case. In July, August, and September, 1776, at Oxford, they were sometimes seen, towards the evenings, in such myriads as literally to darken the rays of the sun; and their repeated bites often swelled the exposed parts of the body to an enormous size, and caused the most troublesome and unpleasant sensations. Mr. Swinton, who has given an account of them in the Philosophical Transactions, has stated that he was one evening in the garden of Wadham College, about half an hour before sun-set, in company with another gentleman, when they were observed in numbers almost unexampled. Six distinct columns were observed to ascend from the tops of six branches of an apple-tree in an adjoining garden, separated from that in which they were stationed by a wall at least fifty or sixty feet in height. Two of these columns seemed perfectly erect, three of them were oblique, and one approached somewhat of a pyramidal form. The bodies of some of the Gnats were

greatly distended with blood; one, considerably larger than the rest, had as much blood expressed from it as besmeared a space of three inches square. About thirty years before this period, many columns of Gnats were observed to rise from the top of the cathedral church at Salisbury. At a little distance they had so great a resemblance to smoke, as, at first, to occasion considerable alarm lest the church was on fire.

It is impossible to behold and not admire the beautiful structure of the proboscis of the Gnat, through which it draws the juices that afford it nourishment. The naked eye is only able to discover a long and slender tube, containing five or six spiculæ of exquisite fineness. These spiculæ, introduced into the veins of animals, act like the suckers of a pump, and cause the blood to ascend. The insect injects a small quantity of liquid into the wound, by which the blood is made more fluid.—The animal swells, grows red, and does not quit its hold till it has gorged itself. The liquor it has injected causes, by its fermenting, a disagreeable itching, which may be removed by volatile alkali, or by immediately rubbing and washing the place with cold water.

Gnats are said sometimes to shine in the dark.

The *Musqueto-fly* is nothing more than a large variety of the Common Gnat. It is found in great abundance in the woody and marshy parts of all hot climates; and, during their short summer, throughout Lapland, Norway, and Finland, and other countries equally near the pole.

It is the female only that bites and sucks the blood; and this operation is so severe, as to swell and blister the skin in a most violent manner, and sometimes even to leave obstinate sores. Musquetoes are found in such

swarms in the woods, that whoever enters them, is sure to have his face covered, and he is scarcely able to see his way before him. A swelling and disagreeable itching immediately follow the puncture, and these are succeeded by small white ulcers; so that the face of a person coming from the country is scarcely to be recognised, appearing full of blotches. Even gloves are not always found a protection against these troublesome insects.

Whilst the Laplanders are employed in the woods, on the necessary business of cutting timber, they are unable to take the refreshment of their meals; for their mouths, as soon as opened, would be filled with Musquetoes. If the wind happen to blow briskly, the animals disappear for the time; but no sooner is it again calm than they return, and crowd every place.—They also dreadfully infest the cattle and rein-deer. When these return from the woods, they are found covered with Musquetoes; and, on the insects being swept from their backs and sides, their skins are red with blood.

The lowest class of people, in all the climates where Musquetoes abound, keep them out of their huts, during the day, by burning there a continual fire: the Laplander has a better contrivance to defend himself from their stings while in bed. He fixes a leather thong to the poles of his tent, over his bed, which raises his canvas quilt to a proper height, so that its sides or edges touch the ground. Under this he creeps, and passes the night in security.—When Mr. Acerbi and his friends arrived in a cottage in the village of Kollare, in Lapland, the first favour the women conferred on them, was to light a fire, and fill the room so full of smoke, that it brought tears from their eyes. This was done to deliver them from the molestation of the Musquetoes; and, as a means of effectual prevention, they made a second fire, near the entrance of the apartment,

to stop the fresh myriads, which, after the death of these, would otherwise have rushed in upon them from without.

The buzzing of the Musquetoes is so loud, as to disturb the rest of persons in the night, almost as much as would be done by their bite. The more opulent inhabitants of climates where they abound, usually sleep under nets of gauze.

OF THE HIPPOBOSCÆ OR *SPIDER-FLIES**.

The Hippoboscæ form a connecting link betwixt the two-winged and the apterous insects. By some authors they have been denominated *mouches araignées*, or *spider-flies*, from a distant resemblance which some of them have to those insects.

A few of the species are found in woods and marshy places; but the greater part of them infest the bodies either of quadrupeds or birds.

THE FOREST-FLY †.

In the neighbourhood of the New Forest, in Hampshire, and in several other parts of England, these insects are

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* The mouth is furnished with a short, cylindrical, straight, two-valved sucker; the valves of which are equal. The antennæ are filiform. The feet are armed with numerous claws; and the body is flat and hard.

† DESCRIPTION. The general colour is brown; the thorax varied with pale yellow, and the legs annulate with yellow and brown. The wings are obtuse: they cross each other and are hyaline, with a brown spot near the outer margin. The feet are furnished with four claws.

SYNONYMS. Hippobosca equina. *Linnæus.*—L'Hippobosque du Cheval. *Cuvier.*

extremely numerous during the summer season. They collect sometimes in great numbers, upon the necks and shoulders, under the belly, on the interior part of the thighs, and under the tails of horses, where they run about with an oblique motion, and feed by sucking the blood of these animals through their proboscis. They adhere so firmly with their claws to the hair, that they cannot, without great difficulty, be driven away; and even if this happen to be done, they almost always return after a short flight. So hard and tough are their skins, that it is almost impossible, byc rushing, to kill them; and the almost only effectual mode of destroying them is, by tearing off their heads.

To all horses that are unaccustomed to their attacks, the Forest-flies are peculiarly obnoxious, nor is it until after a considerable lapse of time, that high-spirited and tender-skinned animals become reconciled to them.

In the production of their offspring these insects are very peculiar. Each female has but one egg at a time. This is extremely singular in its form and appearance, and, in size, is nearly as large as the belly of the parent. She fastens it to the hairs of the horse, by means of a gluey matter with which it is covered, and in some place where it is not liable to be rubbed off. To those persons who might be inclined to consider it impossible for so small an insect to produce from its body so large a substance, it may be observed, that the skin of the Forest-fly is like a bladder or purse, very tough, and capable of great expansion.

I have called the above mentioned production, the egg of the Forest-fly, but in this particular I do not speak correctly; for it should appear, that the real egg is hatched within the body of the insect, where the larva also completes its growth, and that this substance is the *pupa*, enclosed in a kind of skin, which is so tough and strong, as to be capable of sheltering it from all injury. From its

first extrusion it may be observed to have a slight movement, an alternate retracting and expanding of the skin, somewhat similar to the beating of the heart.

At one of the ends there is a kind of valve or cap, divided into two equal pieces. As soon as the insect becomes perfected, it pushes this open with its head, and issues forth.

Forest-flies are occasionally found upon cattle; and, in open countries, even upon dogs.

MAHARAJA SERFOGI'S SARASWATI MAHAL. TAN

Apterous Insects*.

OF THE TERMES TRIBE†.

The present tribe is arranged by Linnæus among the Apterous Insects: but it might with equal propriety have been inserted with the Neuroptera or Hymenoptera; for the males of most of the species, in a perfect state, have either two or four wings.

THE DEATH-WATCH TERMES ‡.

In old wood, decayed furniture, museums, and neglected books, these insects are almost always to be found; and both the male and female have the power of making a ticking noise, not unlike that of a watch, for the purpose of attracting each other. When disturbed they are immediately silent; but if they can be viewed without molesta-

* The Linnean order *Aptera*, comprises all such insects as are destitute of wings in both sexes.

† The mouth is furnished with two horny jaws, and has also a horny four-cleft lip. The feelers are four in number, thread-shaped, and equal. The antennæ in some of the species are beaded, and in others tapering.

‡ Description. This insect is about a tenth of an inch long. At first sight it has greatly the appearance of a louse: its mouth, however, with a glass, is seen to be reddish, and its eyes are yellow. The antennæ are sharply pointed and somewhat long. It is sometimes, though very rarely, observed to have wings.

Synonyms. Termes pulsatorium. *Linn.*—Procus pulsatorius. *Fabricius.*

tion, they will not only beat freely, but will even answer any person's beating with his nail. At every stroke their body shakes, or seems affected by a sudden jerk; and these jerks succeed each other so quickly, that it requires great steadiness to perceive, with the naked eye, that the insects are at all in motion. They are scarcely ever heard before the month of July, and never later than the sixteenth of August. It appears strange, that so small an animal should be able to make a noise so loud, as sometimes to equal that of the strongest beating watch. Dr. Derham seems to have been the first naturalist who examined and described this species. He had often heard the noise, and in pursuing it had found nothing but these insects, which he supposed incapable of producing it; but one day finding that the noise proceeded from a piece of paper loosely folded, and lying in a good light in his study window, he viewed it through, and with a microscope observed, to his great astonishment, one of them in the very act of beating. In some years they are more numerous than in others, and their ticking is of course more frequently heard. Dr. Derham says, that during the month of July, in one particular summer, they scarcely ever ceased, either in the day or night.

The female lays her eggs in dry and dusty places, where they are not likely to meet with the least disturbance. These are exceedingly small, and in appearance, are not unlike the nits or eggs of lice. They are generally hatched about the beginning of March, or a little sooner or later, according to the weather. After leaving the egg, the animals are so small, as scarcely to be discerned, without the assistance of a glass. They continue in the larva state, in which they somewhat resemble the mites in cheese, about two months; after which they undergo their change.

They subsist on dead flies and other insects; and, from their numbers and voracity, oftentimes commit much

damage in cabinets of natural history. They also live on other substances, and may frequently be observed hunting for nutritious particles, with great care and attention, among the dust in which they are found; turning it over with their heads, and searching among it somewhat in the manner of swine. Many of them live through the winter; but, during that time, in order to avoid the inconveniences of frost, they bury themselves deep in dust.

The Death-watch Termes seems to have very little alliance to the following species.

THE WHITE ANTS*.

The animals of this extraordinary community are found in the East Indies, and in many parts of Africa and South America, where their depredations are greatly dreaded by the inhabitants. Mr. Smeathman, whose account of them occupies above fifty pages in the seventy-first volume of the Philosophical Transactions, says, that they are naturally divided into three orders: 1. The working insects, which he distinguishes by the name of *labourers;* 2. The fighters, or *soldiers*, which perform no other labour than such as is necessary in defence of the nests; and 3. The winged or perfect insects, which are male and female, and capable of multiplying the species. The latter he denominates the *nobility* or *gentry;* because they neither labour nor fight.

In their nest or hill, for they build on the surface of the ground, the labourers are always the most numerous, there being at least a hundred labourers to one of the fighting insects or soldiers. In this state they are about a quarter of an inch in length.

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* Synonyms. Termes fatale. *Linn.*—Le Thermès fatale. *Tigny.*

The second order, or soldiers, differ in figure from the labourers. These appear to be such insects as have undergone one change toward their perfect state. They are now nearly half an inch in length, and equal in size to about fifteen of the labourers. The shape of the head is likewise greatly changed. In the former state, the mouth is evidently formed for gnawing, or for holding bodies; but, in this state, the jaws being shaped like two sharp awls, a little jagged, are destined solely for piercing or wounding. For these purposes they are well calculated; being as hard as a crab's claw, and placed in a strong horny head, which is larger than all the rest of the body.

The insect of the third order, or in its perfect state, is still more remarkable. The head, the thorax, and the abdomen, differ almost in the same parts in the labourers and soldiers. The animals are, also, now furnished with four large brownish transparent wings, by which they are enabled, at the proper season, to emigrate, and to establish new settlements. They are likewise greatly altered in their size as well as figure, and have acquired the powers of propagating the species. Their bodies now measure nearly three quarters of an inch in length, their wings, from tip to tip, above two inches and a half, and their bulk is equal to that of thirty labourers, or two soldiers. Instead of active, industrious, and rapacious little animals, when they arrive at their perfect state, they become innocent, helpless, and dastardly. Their numbers are great, but their enemies are still more numerous: they are devoured by birds, by every species of ants, by carnivorous reptiles, and even by the inhabitants of many parts of Africa. After such devastation, it seems surprising that even a single pair should escape. "Some, however," says Mr. Smeathman, "are so fortunate; and being found by some of the labouring insects, that are continually running

about the surface of the ground under their covered galleries, are *elected* Kings and Queens of new states; all those which are not so elected and preserved, certainly perish. The manner in which these labourers protect the happy pair from their innumerable enemies, not only on the day of the massacre of almost all their race, but for a long time after, will, I hope, justify me in the use of the term election. The little industrious creatures immediately enclose them in a small chamber of clay suitable to their size, into which at first they leave but one entrance, large enough for themselves and the soldiers to go in and out at, but much too little for either of the royal pair to use; and, when necessity obliges them to make more entrances, they are never larger; so that, of course, the voluntary subjects charge themselves with the task of providing for the offspring of their sovereigns, as well as of working and fighting for them, until they have raised a progeny capable at least of dividing the task with them."

About this time a most extraordinary change takes place in the queen. The abdomen begins to extend and enlarge to such an enormous size, that an old queen will sometimes have it so much increased, as to be nearly *two thousand times* the bulk of the rest of her body. It is now of an irregular, oblong shape, and is become one vast matrix full of eggs. When these are perfectly formed, they begin to be protruded, and they come forth so quickly, that about sixty in a minute, or upward of eighty thousand in twenty-four hours, are deposited.

The eggs are immediately taken away by the attendants, and carried to the nurseries. Here they are hatched. The young ones are attended and provided with every thing necessary, until they are able to shift for themselves, and take their share in the labours of the community.

The nests, or rather *hills*, of these Ants, (for they are often elevated ten or twelve feet above the surface of the

ground,) are nearly of a conical shape; and sometimes so numerous, as at a little distance to appear like villages of the negroes. Jobson, in his History of Gambia, says, that some of them are twenty feet high, and that he and his companions have often hidden themselves behind them, for the purpose of shooting deer and other wild animals. Each hill is composed of an exterior and an interior part. The exterior cover is a large clay shell, shaped like a dome, of strength and magnitude sufficient to enclose and protect the interior building from the injuries of the weather, and to defend its numerous inhabitants from the attacks of natural or accidental enemies.

The royal chamber is always situated as near the centre of the building as possible, is generally on a level with the surface of the ground, and of an obtuse oval shape within. In the infant state of the colony, it is not above an inch in length; but in time it becomes enlarged to six or eight inches, or more.

The entrances into the royal chamber, not admitting any animal larger than the labourers or soldiers, it follows that the king and queen can never possibly get out. This chamber is surrounded by an hundred of others, of different sizes, figures, and dimensions; all of them arched either in a circular or an elliptical form. These either open into each other, or have communicating passages; which, being always clear, are evidently intended for the convenience of the soldiers and attendants, of whom great numbers are necessary. The latter apartments are joined by the magazines and nurseries. The magazines are chambers of clay, and are at all times well stored with provisions, which, to the naked eye, seem to consist of the raspings of wood and plants; but, when examined by the microscope, they are found to consist chiefly of the gums or inspissated juices of plants, thrown together in small irregular masses.

The magazines are always intermixed with the nurseries, buildings totally different from the rest of the apartments. These are composed entirely of wooden materials, which seem to be cemented with gum. They are invariably occupied by the eggs, and the young ones, which first appear in the shape of labourers. These buildings are exceedingly compact, and are divided into a number of small irregular-shaped chambers, not one of which is half an inch wide. They are placed all round, and as near as possible to the royal apartments.

When a nest is in an infant state, the nurseries are close to the royal apartment. But, as in process of time the body of the queen enlarges, it becomes necessary, for her accommodation, to augment the dimensions of her chamber. She then, likewise, lays a greater number of eggs, and requires more attendants: of course, it is necessary that both the number and dimensions of the adjacent apartments should be augmented. For this purpose, the small first-built nurseries are taken to pieces, rebuilt a little further off, and made a size larger; and their number, at the same time, is increased. Thus the animals are continually employed in pulling down, repairing, or rebuilding their apartments; and these operations they perform with wonderful sagacity, regularity, and foresight.

The nurseries are enclosed in chambers of clay, like those which contain the provisions; but they are much larger. In the early state of the nest they are not bigger than a hazel nut: but in great hills they are oftentimes four or five inches across.

The royal chamber, as before observed, is situated as nearly under the apex of the hill as possible, and is surrounded on all sides, both above and below, by what Mr. Smeathman calls the *royal apartments*, which contain only those labourers and soldiers that are employed in defence of the common parents. These apartments compose an intricate labyrinth, which extends a foot or more in

diameter from the royal chamber on every side. Here the nurseries and magazines of provisions begin; and, being separated by small empty chambers and galleries, which surround them, and communicate with each other, are continued on all sides to the outward shell, and reach up within two-thirds or three-fourths of its height, leaving an open area in the middle under the dome. This is surrounded by large pointed arches, which are sometimes two or three feet high next to the front of the area, but diminish rapidly as they recede, and are soon lost among the innumerable chambers and nurseries behind them. The inferior building, or assemblage of nurseries, chambers, and passages, has a flattish roof without any perforation. By this contrivance, if, by accident, water should penetrate the external dome, the apartments below are preserved from injury. The area has also a flattish floor, which is situated above the royal chamber. It is likewise water-proof, and so constructed, that, if water gets admittance, it runs off by subterraneous passages, which are cylindrical, and some of them so much as even thirteen inches in diameter. These subterraneous passages are thickly lined with the same kind of clay of which the hill is composed: they ascend the internal part of the external shell in a spiral form, and, winding round the whole building up to the top, intersect and communicate with each other at different heights. From every part of these large galleries, a number of pipes, or smaller galleries, leading to different apartments of the building, proceed. There are likewise a great many which lead downward, by sloping descents, to a considerable depth under the surface of the ground. Other galleries ascend and lead out horizontally on every side, and are also carried underground, but near the surface, to great distances, for the purpose of foraging.

When a breach is made in one of the walls, by an ax or

other instrument, the first object that attracts attention, is the behaviour of the soldiers or fighting insects. Immediately after the blow is given, a soldier comes out, walks about the breach, and seems to examine the nature of the enemy, or the cause of the attack. He then goes into the hill, gives the alarm, and, in a short time, large bodies rush out as fast as the breach will permit. It is not easy to describe the fury that actuates these fighting insects. In their eagerness to repel the enemy, they frequently tumble down the sides of the hill, but quickly recover themselves, and bite every thing they encounter. This biting, joined to the striking of their forceps upon the building, makes a crackling or vibrating noise, which is somewhat shriller and quicker than the ticking of a watch, and may be heard at the distance of several feet. While the attack proceeds, they are in the most violent bustle and agitation. If they seize hold of any part of a man's body, they instantly make a wound, which gives some pain. When they attack the leg, the stain of blood upon the stocking extends more than an inch in width. They make their hooked jaws meet at the first stroke, and never quit their hold, but will suffer themselves to be pulled away, piece after piece, without any attempt to escape. On the other hand, if a person keeps out of their reach, and gives them no further disturbance, in less than half an hour they retire into the nest, as if they supposed the monster that damaged their castle had fled. Before the whole of the soldiers have got in, the labouring insects are all in motion, and hasten toward the breach, each of them having a quantity of tempered mortar in his mouth. This mortar they stick upon the breach as fast as they arrive, and perform the operation with so much dispatch and facility, that, notwithstanding the immensity of their numbers, they never stop or embarass one another. During this scene of apparent hurry and confusion, the spectator

is agreeably surprised when he perceives a regular wall gradually rising and filling up the chasm. While the labourers are thus employed, almost all the soldiers remain within, except here and there one, who saunters about among six hundred or a thousand labourers, but never touches the mortar. One soldier, however, invariably takes his station close to the wall which the labourers are building. This soldier turns himself leisurely on all sides, and, at intervals of a minute or two, raises his head, beats upon the building with his forceps, and makes the vibrating noise formerly mentioned. A loud hiss instantly issues from the inside of the dome, and all the subterraneous caverns and passages. That this hiss proceeds from the labourers is apparent; for, at every signal of this kind, they work with redoubled quickness and alacrity. A renewal of the attack, however, instantly changes the scene. "On the first stroke," Mr. Smeathman remarks, "the labourers run into the many pipes and galleries with which the building is perforated, which they do so quickly, that they seem to vanish; for, in a few seconds, all are gone, and the soldiers rush out as numerous and as vindictive as before. On finding no enemy, they return again leisurely into the hill; and, soon after, the labourers appear loaded as at first, as active, and as sedulous, with soldiers here and there among them, who act just in the same manner, one or other of them giving the signal to hasten the business. Thus the pleasure of seeing them come out to fight or to work alternately, may be obtained as often as curiosity excites, or time permits; and it will certainly be found, that the one order never attempts to fight, nor the other to work, let the emergency be ever so great."

It is exceedingly difficult to explore the interior parts of a nest or hill. The apartments which surround the royal chamber and the nurseries, and, indeed, the whole fabric,

have such a dependence on each other, that the breaking of one arch generally pulls down two or three. Another great obstacle is the obstinacy of the soldiers, which, says this gentleman, "fight to the very last, disputing every inch of ground so well as often to drive away the negroes who are without shoes, and make white people bleed plentifully through their stockings. Neither can we let a building stand so as to get a view of the interior parts without interruption; for, while the soldiers are defending the out-works, the labourers keep barricading all the way against us, stopping up the different galleries and passages which lead to the various apartments, particularly the royal chamber, all the entrances to which they fill up so artfully as not to let it be distinguishable while it remains moist; and, externally, it has no other appearance than that of a shapeless lump of clay. It is, however, easily found, from its situation with respect to the other parts of the building, and by the crowds of labourers and soldiers which surround it, who show their loyalty and fidelity by dying under its walls. The royal chamber, in a large nest, is capacious enough to hold many hundreds of the attendants, besides the royal pair; and it is always found as full of them as it can hold. These faithful subjects never abandon their charge even in the last distress; for, whenever I took out the royal chamber, as I often did, and preserved it for some time in a large glass bowl, all the attendants continued running in one direction round the king and queen, with the utmost solicitude, some of them stopping at the head of the latter, as if to give her something. When they came to the extremity of the abdomen, they took the eggs from her, carried them away, and piled them carefully together in some part of the chamber, or in the bowl under, or behind any broken pieces of clay which lay most conveniently for the purpose."

OF THE LOUSE TRIBE.

Lice live on animal juices, which they extract from living bodies by means of their sucker. The *larva* and *pupa* resemble the perfect insect.

The mouth in these animals is formed by a retractile recurved sucker, without a proboscis. There are no feelers, and the antennæ are about the length of the thorax. The abdomen is somewhat flattened; and the legs, which are six in number, are formed not for leaping, but running and climbing.

THE COMMON LOUSE*.

When we examine the human Louse with the microscope, its external deformity strikes us with disgust. The fore part of its head is somewhat oblong, while the hind part is rounded. The skin is hard and transparent, with here and there a few bristly hairs. On each side of its head are two antennæ or horns, jointed, and covered with bristly hair; and behind these are the eyes, which are large and black. The neck is short, and the breast divided into three parts; on each side of which are three legs, armed at the end with small claws, by which the animal is enabled to lay hold of different objects. The trunk, or proboscis, is generally concealed in its tube: this is very sharp, and furnished, towards its upper part, with a few reversed prickles. By means of this the Louse feeds; and, when it is engaged in sucking any animal, the blood may be seen, through the transparency of its external covering, to rush

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* SYNONYMS. Pediculus humanus. *Linn.*—Le Pou humain, in France.

like a torrent into the stomach. Through this its stomach and intestines are also visible, as well as the ramifications of the tracheæ or respiratory tubes, which appear dispersed, in a most beautiful manner, throughout various parts of the animal.

Scarcely any creature multiplies so quickly as this unwelcome intruder. It has been pleasantly said that a Louse becomes a grandfather in the space of twenty-four hours. This fact cannot be ascertained; but nothing is more true than that the moment the nit, which is no other than the egg of the Louse, gets rid of its superfluous moisture, and throws off its shell, it begins to breed in its turn. Nothing so much prevents the increase of this nauseous animal as cold, and want of humidity. The nits, unless they are laid in a place that is warm, do not produce any thing; and from this it is, that many of the nits laid on the hairs in the night-time, are destroyed by the cold of the succeeding day.

In Mexico these animals were so numerous, that the ancient kings found no other means of ridding their subjects of them, than by the imposition of an annual tribute of a certain quantity. Ferdinand Cortes found bags full of them in the palace of Montezuma.

"This is a creature (says Albin) so officious that it will be known to every one at one time or other; so busy, and so impudent, that it will be intruding itself into every one's company; and withal, so proud and aspiring, that it fears not to trample on the best, and affects nothing so much as a crown. It feeds and lives very high; and that makes it so saucy as to pull any one by the ears that comes in its way; and it will never be quiet till it has drawn blood. It is troubled at nothing so much as that a man scratches his head, as knowing that he is plotting and contriving some mischief against it: this makes it oftentimes skulk into some meaner and lower place, and run behind a

man's back, though it go very much against the hair, which ill conditions it, having made it better known than trusted."

OF THE FLEAS IN GENERAL*.

The mouth in the Fleas is without either jaws or feelers, having only a long, inflected proboscis, concealing a single bristle. The antennæ are beaded; the abdomen is compressed sideways; and the legs are six in number, and formed for leaping.

The *larvæ* are white, cylindrical, and without feet, but are very active little creatures. Under the tail there are two small spines. The *chrysalis* is motionless, but in appearance very like the perfect insect. The two following species are all that have been yet discovered.

THE COMMON FLEA*.

Notwithstanding the general disapprobation of this insect, it has certainly something very pleasing in its appearance. When examined with a microscope, it will be observed to have a small head, large eyes, and two short, four-jointed antennæ, between which is situated the trunk, or proboscis. The body appears enveloped in a shelly armour that is always clean and bright: this is beset at the segments with many sharp bristles. All its motions indicate agility and elegance; and its muscular power is so extraordinary as justly to excite our wonder. We know no other animal whatever whose muscular strength can be put in competition with that of a Flea; for, on a moderate computation, it is known to leap to a distance of at least two hundred times its own length.

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* SYNONYMS. Pulex irritans. *Linnæus*.—La Puce irritante, in France.

There is no kind of proportion between the force and size of all the insect tribe. Had man an equal degree of strength, bulk for bulk, with a louse or flea, the history of Samson would be no longer miraculous. A Flea will drag after it a chain a hundred times heavier than itself; and, to compensate for this force, will eat ten times its own weight of provisions in a day. Mr. Boverich, an ingenious watch-maker, who some years ago lived in the Strand, London, exhibited to the public a little ivory chaise, with four wheels, and all its proper apparatus, and a man sitting on the box, all of which was drawn by a single Flea. He made a small landau, which opened and shut by springs, with six horses harnessed to it, a coachman sitting on the box, and a dog between his legs: four persons in the carriage, two footmen behind it, and a postillion riding on one of the fore-horses, which was also easily drawn along by a Flea. He likewise had a chain of brass, about two inches long, containing two hundred links, with a hook at one end, and a padlock and key at the other, which the Flea drew very nimbly along.

This little animal is produced from eggs which the females stick fast, by a kind of glutinous matter, to the roots of the hairs of cats, dogs, and other animals; or to the wool in blankets, rugs, or other similar furniture. Of these eggs the females lay ten or twelve a day, for several days successively; and they are hatched in the same order five or six days after being laid.

From the eggs come forth, not perfect Fleas, but little whitish worms, or maggots, whose bodies have annular divisions, and are thinly covered with long hairs. They adhere closely to the body of the animal, or substance, on which they were produced; and feed on the scurfy excretion of the skin, the downy parts of linen, &c. They are about the fourth of an inch in length, and without feet; but they are, notwithstanding, very lively and active,

When alarmed they suddenly roll themselves into the shape of a little ball. They may be kept in a little box, and brought up with dead flies, which they eat with great voracity.

In eleven days from their being hatched, they leave off eating, and lie as though they were dying; but, if viewed in this state with a microscope, they will be found weaving a silken covering around them, in which they are to change into their chrysalid form. They continue nine days in this shape, at first white, and afterwards by degrees darkening their colour as they acquire firmness and strength. As soon as they issue from their bag, they become perfect Fleas, and are able to leap away.

THE PENETRATING FLEA, OR CHIGOE *,

Is a troublesome insect, too well known in many parts of America. It is so small as to be almost imperceptible. Its legs have not the elasticity of those of fleas; for, if the Chigoes had as great powers of leaping as fleas, there is not a living creature of the climates where they abound that would not be full of them; and this lurking race would destroy three-fourths of mankind by the evils they would produce. They are always found among dust, and particularly in filthy places; they fix themselves on the legs, to the soles of the feet, and even to the fingers.

This creature pierces the skin so subtilely that, at the time, the person is not sensible of it; nor is it to be per-

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* Description. This insect is chiefly distinguished by the length of its proboscis, which is as long as the body. Its colour is reddish-brown. The abdomen of the female, when with egg, increases to nearly a hundred times the usual size.

Synonyms. Pulex penetrans. *Linn*—Jigger, Nigua, and Pique. in various parts of America.—La Puce penetrante. *Cuvier*.

ceived till it begins to extend itself. At first, it is not difficult to extract it; but, although it may only have introduced its head, it makes so firm a lodgment that a part of the skin must be sacrificed before it will quit its hold.

If it is not soon perceived, the insect completes its lodgment, sucks the blood, and forms a nest of a white, thin tunicle, in the shape of a flat pearl. It extends itself in this space in such a manner that its head and feet are toward the exterior side, for the convenience of nourishment; and the other part of the body answers to the inner side of the tunicle, in order to lay its eggs there. In proportion as these are laid the little pearl is enlarged; and in four or five days it is at least two lines in diameter. It is then of the utmost consequence to have it extracted; for if this is neglected it bursts of itself, and spreads an infinity of nits, which, when hatched, fill the whole part, and produce excessive anguish; and the difficulty of dislodging them becomes very great. They penetrate to the very bones; and, even when the sufferer has got rid of them, the pain will last until the flesh and skin are entirely healed.

The operation of extracting them is long and painful. It consists in separating, with the point of a needle, the flesh next to the membrane where the eggs are lodged; which is not easily done without bursting the tunicle. After having separated even the most minute ligaments, the nest is to be extracted. If unfortunately it burst, particular care must be taken to extract every root of it, and especially not to leave behind the principal insect. This would begin to lay its eggs again before the wound could be healed; and, penetrating much further into the flesh, would increase the difficulty of extracting it. During the great heats, extreme care must be taken not to wet the part affected. Without this precaution, experience has proved

that the patient is subject to consequences that frequently prove fatal.

"The Chigoe," says Stedman, "is a kind of small sand-flea, common in Surinam, which gets in between the skin and the flesh without its being felt, and generally under the nails of the toes; where, while it feeds, it keeps growing till it becomes of the size of a large pea, causing no further pain than a disagreeable itching. In process of time it appears in the form of a small bladder, in which are deposited thousands of eggs or nits, and which, if it breaks, produce so many young Chigoes, that in course of time create running ulcers, which are often of very dangerous consequence to the patient; so much so, indeed, that he knew a soldier, the soles of whose feet were obliged to be cut away before he could recover; and some men have lost their limbs by amputation—nay, even their lives, by having neglected, in time, to root out these abominable vermin. The moment, therefore, that a redness and itching, more than usual, are perceived, it is time to extract the Chigoe that occasions them. This is done with a sharp-pointed needle, taking care not to occasion unnecessary pain, and to prevent the chigoe, or bladder, from breaking in the wound. Tobacco ashes are put into the orifice, by which, in a little time, the sore is perfectly healed."

OF THE TICKS IN GENERAL.

These troublesome insects live chiefly on other animals; some of them, however, inhabit the water, and others subsist on various vegetable substances. They are to be found every where, and in immense numbers. The *larvæ* and *chrysalids* have each six feet.

Their mouth is not furnished with a proboscis, but the sucker has a two-valved, cylindrical sheath. They have two compressed feelers, as long as the sucker; two eyes, one on each side of the head; and eight legs.

THE CHEESE-MITE*.

To the naked eye, these minute creatures appear little more than moving particles of dust; but on the application of the microscope they are found to be perfect insects, performing all the regular animal functions.

The females, which are easily distinguished from the males, are oviparous. The eggs are so minute, that on a tolerably accurate calculation it appears, that *ninety millions* of them will not fill the shell of a pigeon's egg. They are hatched in warm weather in about twelve days; but during the winter season, the time of hatching is much longer. When the young ones first come forth they are extremely minute; and before they attain their full size, they cast their skin several times.

The mites are very quick-sighted; and when once they have been touched with a pin, it is easy to perceive a great degree of cunning exerted to avoid a second touch. They are extremely voracious animals, and are often observed even to devour each other; and so very tenacious are they of life, that they have been kept alive many months between two concave glasses, by which they were applied to a microscope. Leeuwenhoek placed a female mite on the point of a pin for examination: she remained there ten days, and during the time laid two eggs; which, for want of other food, she devoured.

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* Description. The head of the Cheese-Mite is small in proportion to the rest of the body. Its legs are furnished at the extremities with little claws, by which it is enabled to lay firm hold of the substances it inhabits. The body is furnished with long hairs, which it has the power of depressing; and by this means it is enabled to creep through crevices that would not otherwise admit its body to pass.

Synonyms. Acarus Siro. *Linnæus.*—La Mitte ciron. *Tigny.*

THE DOG-TICK *.

In thickets and heaths these Ticks are sometimes very abundant. Hence it is that animals which frequent such places, and particularly dogs of the chase, are much exposed to their attacks.

Their abdomen is quite flat and thin when they have been long without nourishment; but, when adhering to the body of an animal, they soon fill themselves with blood, and their size becomes now so much enlarged, that any one unacquainted with their habits and appearance, would, in this state, scarcely recognize them.

Their motions are extremely slow and heavy, but, in compensation for this apparent defect, they are able to adhere closely and strongly even to the most solid bodies. They are very tenacious of life; and their skin is so hard and tough, that they are not easily susceptible of injury of any kind. Long after they are deprived of their head, they give indications of remaining life.

In the destruction of these insects, mercurial preparations have been employed with success.

THE HARVEST-BUG †.

In the months of August and September, the Harvest-Bug, in some of the Southern counties of England, is a

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* Description. The body, when filled with blood, is nearly globular. The abdomen is livid, with a round, brown spot at the base.

Synonyms. Acarus ricinus. *Linn.*—Ixode ricin. *Latreille.*—La Tique. *Cuvier.*

† Description. The Harvest-bug is of a somewhat globular shape, and of a bright red colour, with the abdomen bristly behind.

very troublesome and disagreeable insect. It adheres to the skin by means of two short arms, situated above the upper legs, so firmly as not easily to be disengaged. Wherever it fixes it causes a tumour about the size of a pea, or larger, accompanied by a most unpleasant itching.—Its tubular snout, by which it takes its food, is generally concealed.

These insects abound upon plants, and are generally caught from walking in gardens, among long grass, or in corn-fields.

Mr. White says they are so numerous on the chalky downs of Hampshire, that the warreners' nets are frequently discoloured, from the immense numbers that get upon them; whilst the men are sometimes so bitten as to be thrown into fevers.

*OF THE SPIDERS IN GENERAL**.

These insects, which are so remarkable on account of their industry and manners of life, are generally viewed with a degree of aversion only to be accounted for by the unpleasing impressions made upon us in early life. These impressions are, in general, communicated by persons ill qualified to give the mind that direction which is necessary for the purposes of life. Many naturalists even, have complained that this aversion has deterred them from observing

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It is smaller than the common mite, and, by its colour, but just to be perceived when on the skin. *Shaw.*

Synonyms. Acarus Autumnalis. Autumnal Acarus, or Harvest-Bug. *Shaw's Nat. Mis.*

* Spiders have short horny jaws, and two incurved, jointed, and very sharp feelers. They are without antennæ; and have eight or sometimes only six eyes, and eight legs. Their abdomen is hairy, and furnished with papillæ, from which they spin their webs.

and accurately examining, these insects; and those who have undertaken to do so, have generally been at much trouble to overcome their antipathy. Roesel accustomed himself to view the insects first at a distance: he then considered their webs; and, at last, looked at the insects themselves, through a microscope. Göze viewed individual parts of Spiders, till he was able to look, without any sentiment of aversion, at the entire insect. Both these naturalists so far conquered their antipathy, that they could afterwards handle and examine Spiders with perfect indifference.

Spiders prey on other insects, and do not, in all cases, spare even their own species. There is little doubt but their bite is venomous; and it is said that a fly which has once felt it can never be recovered, but soon dies in convulsions. Many of the species have been swallowed, without any subsequent inconvenience.

Some of the Spiders spin webs for the purpose of catching their prey; but others seize it by surprise. They are all able to sustain an abstinence from food for a great length of time; some for even six months, or upwards.

They frequently change their skins.—The *larvæ* and *pupæ* have each eight legs, and differ in no respect from the perfect insect.

THE HOUSE SPIDER *.

House-spiders feed principally on flies; and the web by which they are enabled to entangle these insects is a sur-

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* Description. The abdomen of these insects is nearly oval, of a brown colour, and marked with five black and almost contiguous spots.

Synonyms. Aranea domestica. *Linn.*—L'Araignée domestique. *Tigny.*

prising part of the animal economy.—For the purpose of forming this web, they are supplied with a quantity of glutinous matter contained in a receptacle near the extremity of their bodies; and they have five teats for spinning it into thread, the orifices of which the insects have the power of contracting and dilating at pleasure. When they enter on the construction of this curious fabric, they fix on a spot of apparent plunder and security.—The animal then distils one little drop of glutinous liquor, which is very tenacious; and creeping along the wall, and joining its thread as it proceeds, darts itself to the opposite side, where the other end is to be fastened. The first thread thus formed, being drawn tight and fixed at each end, the Spider runs on it backward and forward, still doubling and strengthening it, as on this depends the stability of the whole. The scaffolding thus completed, it makes a number of threads parallel to the first, and then crosses them with others, the clammy substance of which they are formed serving, when first made, to bind them to each other. At the bottom of the web a kind of funnel is constructed, in which the little creature lies concealed. In this den of destruction it watches with unremitted assiduity till its prey is entangled, and on which it instantly darts with inevitable ruin.

The web of the Spider differs from those woven by any human artist in this circumstance, that, in our work, the threads extended in length are interlaced with those that are carried on transversely; whereas the threads of a Spider's woof only cross the threads of the warp, and are glued to them in the points where they mutually touch, and are not either inserted or interwoven.

The threads along the border of the work are doubled or trebled, by the Spider's opening all her teats at once, and glueing several threads one over another; sensible that the extremity of the web ought to be hemmed and fortified, in order to preserve it from being torn. She likewise further

secures and supports it with strong loops, or double threads, which she fixes all around it, and which hinder it from being the sport of the winds.

From time to time she finds it necessary to clear away the dust, which would otherwise incommode her web, and she sweeps the whole by giving it a shake with her paw; but in doing this she so nicely proportions the force of the blow to the strength of the work, that nothing is ever broken.

From all parts of the web are drawn several threads, which terminate like rays in a centre at the place of her concealment. The vibration of any of these threads is communicated to her, and gives her notice whenever there is game in the net, and accordingly she springs upon it in an instant. She derives another advantage from this retreat under her web, and that is the opportunity it affords of feasting on her prey in full security; and besides this, it gives her the power of concealing the carcasses, and not leaving in the purlieus any traces of her barbarity capable of intimating the place of her resort, and inspiring other insects with the dread of approaching it.

But chief to the heedless flies the window proves
A constant death; where, gloomily retir'd,
The villain Spider lives: cunning, and fierce,
Mixture abhorr'd! Amid a mangled heap
Of carcasses, in eager watch he sits,
O'erlooking all his waving snares around.
Near the dire cell the heedless wanderer oft
Passes, as oft the ruffian shows his front.
The prey at last ensnar'd, he dreadful darts
With rapid glide along the leaning line:
And, fixing in the wretch his cruel fangs,
Strikes backward, grimly pleas'd: the fluttering wing
And shriller sound declare extreme distress,
And ask the helping hospitable hand.

This Spider is furnished with a pair of sharp hooked fangs, enclosed, when at rest, in cases in the fore-part of his head. With these weapons, (which a good glass will discover to have a small slit or orifice in each point,) he seizes and pierces such insects as entangle themselves in his web; and infuses a poisonous liquid into the wound. This poison must be very active and deleterious; for flies, and many other insects, may be mutilated by depriving them of their legs, wings, and even cutting their bodies through the very middle of the abdomen, and in that condition will survive several days; but this liquid in a moment kills them.

When two Spiders of the same size meet in combat, neither of them will yield: they hold each other by their fangs so fast, that, in general, one of the two must die before they are separated.—M. Leeuwenhoek says he saw one Spider that was, however, only wounded in the leg by his antagonist. A drop of blood, as large as a grain of sand, issued from the sore; and, not being able to use this wounded leg in running away from his enemy, he held it up, and presently afterwards the whole limb dropped from his body. When Spiders are wounded in the breast or upper parts of the body, they always die.

The spider, the ptinus, and many insects of the beetle kind, exhibit an instinct of a very extraordinary nature. When put in terror by a touch of the finger, the Spider runs off with great swiftness; but if he finds that, whatever direction he takes, he is opposed by another finger, he then seems to despair of being able to escape, contracts his limbs and body, lies perfectly motionless, and counterfeits every symptom of death. "In this situation," says Mr. Smellie, "I have pierced Spiders with pins, and torn them to pieces, without their discovering the smallest marks of pain. This simulation of death has been ascribed to a strong convulsion, or stupor, occasioned by terror. But

this solution of the phænomenon is erroneous. I have repeatedly tried the experiment, and uniformly found, that, if the object of terror be removed, in a few seconds the animal runs off with great rapidity. Some beetles, when counterfeiting death, will suffer themselves to be gradually roasted without moving a single joint."

When this animal changes its skin, which it does at certain seasons, an opening may be seen, if carefully watched, in the belly. Through this it draws all its limbs, and leaves the old covering hanging to the cord that sustained it during the operation.

The eyes of all the Spiders are placed on the upper part of the head, but in various positions. They have no muscles belonging to them, and are therefore altogether immoveable. They also consist only of one lens each, and do not, as in other insects, possess the faculty of multiplying objects; but their number and situation enable the animals to see perfectly well in all necessary directions.

THE GARDEN SPIDER*.

The labour of the Garden Spider is very different from that of the former species; yet it is not performed with less art. When desirous of flitting from one place to another, this animal fixes one end of a thread to the place where she stands, and then with her hind paws draws out several other threads from the nipples, which, being lengthened

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* DESCRIPTION. The body of this Spider is brown and somewhat downy. On the thorax are four furrows, of which the two middle ones diverge towards the head. The abdomen, which is nearly spherical, hath, from its middle to the extremity, three white lines.

SYNONYMS. Aranea horticola. *Olivier. Latreille.*—L'Araignée jardinière, in France.

out, and driven by the wind to some neighbouring tree, or other object, are, by their natural clamminess, fixed to it. When she finds that these are fastened, she makes of them a bridge, on which she can pass or repass at pleasure. This done, she renders the thread still thicker, by spinning others to it. From this thread she often descends, by spinning downward to the ground. The thread formed by the latter operation she fixes to some stone, plant, or other substance. She re-ascends to the first thread, and at a little distance from the second begins a third, which she fixes in the same manner. She now strengthens all the three threads, and, beginning at one of the corners, weaves across, and at last forms a strong and durable net, in the centre of which she places herself, with her head downward, to wait for her prey.

From its having been frequently remarked that Spiders spread their webs in solitary and confined places, to which it is sometimes difficult for flies to penetrate, M. de Vaillant naturally concluded that these creatures must often remain long without food, and that, consequently, they were capable of enduring considerable abstinence.

To ascertain the truth of this circumstance, he took a large Garden Spider, whose belly was about the size of a nut, and enclosed it under a glass bell, which he secured with cement round its bottom, and left in this situation for ten months. Notwithstanding this deprivation of food, it appeared during the whole time equally vigorous and alert; but its belly decreased, till at last it was scarcely larger than the head of a pin.

He then put under the bell to it another Spider of the same species. For a little while they kept at a respectful distance from each other, and remained motionless; but presently the meagre one, pressed by hunger, approached and attacked the stranger. It returned several times to the charge; and, in these different conflicts, its enemy became

deprived of almost all its claws: it carried these away, and retired to its former situation to devour them. The meagre one had likewise lost three of its own claws, on which also it fed; and M. Le Vaillant perceived that, by this repast, its plumpness was in some measure restored. The day following, the new comer, deprived of all its means of defence, fell a complete sacrifice. It was speedily devoured; and, in less than twenty-four hours, the old inhabitant of the bell became as plump as it was at the first moment of its confinement.

From the bags in which the young of the Garden Spider are produced, an attempt has been made to manufacture a kind of silk, which has, in a degree, proved successful. With some trouble, thirteen ounces of these bags were collected. They were beaten for some time with a stick, to free them from dust, and then washed in warm water till they were perfectly clean. After this they were steeped in a pot with soap, nitre, and gum arabic, and then boiled in the same mixture over a gentle fire for two or three hours. Clean warm water was again used to free them from the soap, &c.; and, after having been laid for some days to dry, they were loosened with the fingers previously to being carded by the common silk-carders. A beautiful ash-coloured silk was thus obtained, easy to be spun, and much stronger in the thread than that of the silkworm. This was woven in a stocking-weaver's loom, and there can be no doubt but it would bear any other loom. The thirteen ounces of bags yielded nearly four ounces of silk, three of which made a pair of stockings large enough for a man.—It would be a difficult task to obtain bags sufficient to render the manufacture of the silk of any importanee, since to obtain one pound of silk, no fewer than 28,000 bags would be wanted; and for this quantity a greater number of spiders than this must be bred, as none but the females spin them. But a still

greater difficulty arises from their carnivorous disposition in devouring each other. Had this not been the case, a very nutritious food might have been adopted for them in the soft substance of fresh quills. If the silk had answered, we should have had from the different species of spiders, several genuine colours in silk; such as gray, white, sky-blue, and coffee colour: whereas, silkworms yield only white and orange colour.

The females lay six or seven hundred eggs in the same bag. This is generally done in August or September, and about sixteen days afterward the young are hatched. If the weather continue cold, the young ones remain in their nidus for several months without eating or increasing in bulk; but make their appearance abroad at the commencement of the warm weather. The old ones live but a short time after the eggs are laid.

THE WANDERING SPIDER *.

This Spider, which is very common on plants, does not lie in wait for its prey, like several others; it is a lively and active hunter. Its head is furnished, as in the rest, with immoveable eyes. Without any motion of the head, it perceives all the flies that hover around; it does not alarm, but stretches over them its arms, furnished with feathers, which prove nets that entangle their wings. The spider seizes them with its merciless claws, and sucks their blood.

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* Description. The colour of the Wandering Spider is reddish brown, darker on the thorax than the abdomen. This part has, on each side, towards the top, a blackish line, or a brown spot. The two anterior legs, which are long, have blackish rings. The four hind legs are very short.

Synonyms. Aranea viatica. *Linn.*—L'Araignée rurale. *Latreille.*

In its general form, as well as in its manner of running, it has much the appearance of a small crab. It carries its eggs enveloped in a small bag of whitish silk.

THE JUMPING SPIDER*.

The manners of the Jumping Spider are very singular. It does not, like many others, take its prey by means of a net, but is constrained to seize them only by its own activity. It is extremely nimble, at times leaping like a grasshopper, then standing still, and raising itself on its hind legs to look around for its prey. If it see a fly at the distance of three or four yards, it does not run directly to it, but endeavours, as much as possible, to conceal itself till it can arrive near; and then creeping slowly up, and but seldom missing its aim, it springs upon the insect's back, in which case it is almost impossible for the fly to effect an escape. But if, before the spider gets to it, the fly take wing and fix upon another place, the little animal whirls nimbly about, and still keeps its eye upon it, in order to commence a fresh attack. Dr. Brookes says, it has been sometimes seen in the act of instructing its young ones how to hunt; and also that, whenever an old one missed his leap, it would run from the place, and hide itself in some crevice, as if ashamed of its mismanagement!!!

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* DESCRIPTION. The abdomen is oblong, and has three semicircular white lines on each side. The body is covered with silvery hair. The legs are short, hairy, black, and white.

SYNONYMS. Aranea scenica. *Linn.*—L'Araignée Chevronnée, in France.

THE WATER-SPIDER*.

This singular little creature is a very common inhabitant of our fresh waters. When in the water, its belly appears as if covered with a silver varnish. This is, however, nothing more than a bubble of air, attached to the abdomen by the oily humours which transpire from the body, and prevent the immediate contact of the water. By means of this kind of bubble, the insect forms its dwelling under the water. It fixes several silky threads to the stalks of the water-plants, and then, ascending to the surface, thrusts the hinder part of its body above the water, drawing it back with so much rapidity, as to attach beneath a bubble of air, which it has the art of detaining below, by placing it under the threads above mentioned, and which it bends, like a covering, almost round it. It then again ascends for another air-bubble, and thus proceeds till it has constructed a large aërial apartment under the water, which it enters into or quits at pleasure. The male constructs for himself one near that of the female, and afterward breaks through the thread walls of the female's dwelling; and the two bubbles, attached to the bellies of both, unite into one, forming one large chamber. The female takes care of the young, and constructs similar apartments for them.

The figure of this spider has in it nothing remarkable,

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* DESCRIPTION. The Water-spider is of a brown colour, and somewhat downy. The male is much larger than the female. In both sexes the two anterior legs are much longer than the others, and the nippers are very large. On the abdomen there are many transverse wrinkles; and on the back there are two impressed dots.

SYNONYMS. Aranea aquatica. *Linn.*—L'Araignée aquatique. *Tigny.*

and will be overlooked among a crowd of curiosities, if the spectator be unacquainted with its singular art of constructing an habitation under water, and thus availing itself of the properties of both elements. It lodges, during the winter, in empty shells, which it dexterously closes up with a web.

THE GOSSAMER SPIDER *.

The following observations on the origin of the Gossamer, by M. Bechstein, a German naturalist, are curious, and convey a more accurate account of it than I have been able to meet with in any other writer:

" Some naturalists (says this gentleman) have considered this phænomenon as the evaporation of plants condensed, during the cool days of harvest, by the air, and converted into threads like those which can be drawn from resinous juices; others, as the production of a kind of spider, on account of its similarity to the threads of common spiders: and M. Pereboon has discovered a kind of beetle, furnished with a vesicle on its back; from the hinder parts of which, on both sides, proceed two threads, that extend over the extremity of the body, and end in a double thread, sometimes ten or more inches in length, which thread he supposes to form the Gossamer.

" Having made, for many years, the closest observations on this phænomenon, I am of opinion it is caused by a species of field spider, so small and active, as to be imperceptible, unless the observer possess a very acute sight. This spider, if it have no name already, I propose to call the Gossamer Spider, *Aranea Obtextrix*. It is about the size of the head of a small pin. Its head is somewhat

* Aranea Obtextrix?

long, and has in the fore-part eight gray eyes, placed in a circular form. The body is of a shining dark brown colour, with the abdomen shaped like an egg. The legs are yellowish.

"These spiders first appear in the beginning of October, in woods, gardens, and meadows, where their eggs are hatched in safety: thence they spread themselves over whole districts, and, during the rest of October, and till the middle of November, may be found in dry fields throughout Europe. Extensive tracts of land are sometimes seen swarming with them. In the beginning of October, when but very few are hatched, some single threads of their webs, extending from twig to twig, are seen only in the sunshine; about the middle of the month their threads are more perceptible; and toward the end, if a person stand in such a position as to see the sun-beams play on the slender threads, hedges, meadows, corn-fields, stubble land, and even whole districts, appear covered as with a sort of fine white gauze.

"The Gossamer spider does not weave a web, but only extends its thread from one place to another. These are so delicate, that a single thread cannot be seen unless the sun shines on it. One of them, to be visible at other times, must be composed of at least six common threads twisted together. In serene, calm days, these spiders work with great diligence, especially after the disappearance of the morning fogs. Between twelve and two, however, their industry excites the greatest admiration. A person with a pretty quick eye, or by the help of a glass, may sometimes perceive among the barley-stubble such a multitude of these insects, extending their threads, that the fields appear as if covered with swarms of gnats.

"Several of the single threads become twisted together by the gentlest breath of wind, and form perceptible threads, which, being broken by stronger winds, unite

into thick threads, or even into balls, and float through the atmosphere. These are then called in Germany, the *flying summer*, because the summer seems to fly away at the same time. The spiders are conveyed in them: but it is not uncommon to find spiders of other species in them, which have been entangled and dragged away; and even the webs of other spiders, and the dried husks of insects that have been caught by them, are often found in the Gossamer.

"The Gossamer Spiders appear in swarms only during the harvest; but single spiders are to be found through the whole summer."

We have a very curious account of the Gossamer, inserted by Mr. White, in the Natural History of Selborne. "On September the 21st, 1741, being then on a visit, and intent on field diversions, I rose before day-break. When I came into the enclosures, I found the stubbles and clover-grounds matted all over with a thick coat of cobweb, in the meshes of which a copious and heavy dew hung so plentifully, that the whole face of the country seemed, as it were, covered with two or three setting-nets drawn one over another. When the dogs attempted to hunt, their eyes were so blinded and hood-winked, that they could not proceed, but were compelled to lie down and scrape the incumbrances from their faces with their fore-feet; so that, finding my sport interrupted, I returned home, musing in my mind on the oddness of the occurrence.

"As the morning advanced, the sun became bright and warm, and the day turned out one of those most lovely ones, which no season but the autumn produces; cloudless, calm, serene, and worthy of the south of France itself.

"About nine, an appearance very unusual began to demand our attention; a shower of cobwebs falling from very elevated regions, and continuing, without any inter-

ruption, till the close of the day. These webs were not single filmy threads, floating in the air in all directions, but perfect flakes or rags, some nearly an inch broad, and five or six long, which fell with a degree of velocity, that showed they were considerably heavier than the atmosphere.

"On every side, as the observer turned his eyes, he might behold a continual succession of fresh flakes falling into his sight, and twinkling like stars, as they turned their sides toward the sun.

"How far this wonderful shower extended it would be difficult to say; but we know that it reached *Bradley*, *Selborne*, and *Alresford*, three places which lie in a sort of triangle; the shortest of whose sides is about eight miles in extent.

"At the second of these places there was a gentleman (for whose veracity and intelligent turn of mind I have the greatest veneration) who observed it the moment he got abroad; but concluded that, as soon as he came upon the hill above his house, where he took his morning rides, he should be higher than this meteor; which, he imagined, might have been blown, like *thistle-down*, from the common above. But, to his great astonishment, when he rode to the most elevated part of the down, 300 feet above the level of his fields, he found the webs, in appearance, as much above him as before; still descending into sight in a constant succession, and twinkling in the sun, so as to draw the attention of the most incurious observer.

"Neither before nor after this was any such fall observed; but on this day the flakes hung on the trees and hedges so thick, that a diligent person sent out might have gathered baskets full.

"The remark that I shall make on these cobweb-like appearances, called *Gossamer*, is, that, strange and superstitious as the notions about them were formerly, nobody in

these days doubts but that they are the real production of small spiders, which swarm in the fields in fine weather in autumn, and have a power of shooting out webs from their tails, so as to render themselves buoyant, and lighter than air. But why these apterous insects should *that day* have taken such a wonderful aërial excursion, and why their webs should at once have become so gross and material as to be considerably more weighty than air, and to descend with precipitation, is a matter beyond my skill. If I might be allowed to hazard a supposition, I should imagine, that those filmy threads, when first shot, might be entangled in the rising dew, and so drawn up, spiders and all, by a brisk evaporation, into the regions where clouds are formed; and if the spiders have a power of coiling and thickening their webs in the air, as Dr. Lister says they have, then, when they become heavier than the air, they must fall.

"Every day in fine weather, in autumn chiefly, do I see these spiders shooting out their webs and mounting aloft: they will go off from your finger, if you take them into your hand. Last summer one alighted on my book, as I was reading in the parlour; and, running to the top of a page, and shooting out a web, took its departure from thence. But what I most wondered at was, that it went off with considerable velocity in a place where no air was stirring; and I am sure I did not assist it with my breath. So that these little crawlers seem to have, while mounting, some locomotive power without the use of wings, and to move in the air faster than the air itself."

THE TARANTULA *.

The Tarantula Spider is a native of Italy, Cyprus,

* Description. This spider is somewhat more than an inch in

Barbary, and the East-Indies. This animal lives in fields, and its dwelling is about four inches deep, half an inch wide, and closed at the mouth with a net. These spiders do not live quite a year. They lay about 730 eggs, which are hatched in the spring. The parents never survive the winter.

Inflammation, difficulty of breathing, and sickness, are said to be the invariable consequences of the bite of this creature. Dr. Mead, and other medical men, have countenanced the ridiculous story of these effects being counteracted by the power of music. It is, however, now well known, that this singular mode of cure was nothing more than a trick frequently practised on credulous travellers, who were desirous of witnessing it. Mr. Swinburne, when he was in Italy, minutely investigated every particular relative to this insect. The season was not far enough advanced, and it was pretended that no persons had that year been yet bitten: he, however, prevailed upon a woman, who had formerly been bitten, to dance the part before him. Several musicians were summoned, and she performed the dance, as every one present assured him, to perfection. At first she lolled stupidly on a chair, while the instruments played a dull strain. They touched at length the chord supposed to vibrate to her heart; and up she sprang with a hideous yell, staggered about the room like a drunken person, holding a handkerchief in both hands, raising them alternately, and moving in very true time. As the music grew brisker, her motions quickened, and she skipped about with great vigour, and in a variety of steps, every now and then shrieking very loud.

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length. The breast and belly are of an ash-colour. The legs are likewise ash-coloured, with blackish rings on the under part. The fangs are red within.

SYNONYMS. Aranea Tarentula. *Linn.*—L'Araigné Tarentule.

The scene was unpleasant, and, at his request, an end was put to it before the woman was tired.

He informs us, that, wherever they are to dance, a place is prepared for them, hung round with bunches of grapes and ribbons. The patients are dressed in white, with red, green, or yellow ribbons; on their shoulders they have a white scarf; they let their hair fall loose about their ears, and throw the head quite back. He says, that they are exact copies of the ancient priestesses of Bacchus. The introduction of Christianity abolished all public exhibitions of heathenish rites; but the women, unwilling to give up their darling amusment, in performing the frantic character of Bacchantes, devised other pretences; and he supposes that accident led them to the discovery of the Tarantula, on the strength of whose poison the Puglian dames still enjoy their old dance, though time has effaced the memory of its ancient name and institution

If these dancers are at any time really and involuntarily affected, Mr. Swinburne supposes it must be from some attack upon the nerves, a kind of St. Vitus's dance.

THE BIRD-CATCHING SPIDER*.

If the spiders that are found in Europe are looked upon with aversion and alarm, by those who are in the habit of constantly seeing them, surely this American species, whose gigantic size and great muscular power, render it a terror even to the feathered tribes, cannot be beholden without the most violent sensations of horror.

The legs of this enormous creature extend over a space of near ten inches. From the head to the extremity of the

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* Synonyms. Aranea avicularia. *Linn.*—L'Araignée aviculaire. *Tigny.*

abdomen, it often measures above three inches. The legs are as thick as a goose's quill, and closely covered with hair. The body is brown, and the fangs are as strong and sharp as in some of the rapacious species of birds. It is not uncommon in many parts of America, but is principally found in the southern division of that continent, and particularly in Guiana.

Captain Stedman, while residing in Surinam, had one of them given to him, which he put into a case-bottle above eight inches high; and, when this was filled with spirits, the animal reached the surface with some of its claws, while others rested on the bottom. On the whole, he says, this spider is so hideous a creature, that the very sight of it is sufficient to occasion a tremor of abhorrence, even in persons most accustomed to inspect the deformities of nature.

It resides in trees, and frequently seizes on small birds, which it destroys by sucking their blood, after having first wounded them by its fangs, which distil a poisonous liquid into the wound. The slit or orifice near the tip of the fangs, through which the poison is emitted, is so visible, as to be distinctly perceived without a glass.

The eight eyes of this terrible insect are placed somewhat in the form of an oblong square, in front of the thorax. Of these, the two middle ones are so large, as to be capable of being set in the manner of glasses, and used as microscopes: the rest are smaller, and of an oval shape. The thorax is orbicular, and has a transverse central excavation.

In Jamaica there is a kind of spider*, the female of which digs a hole in the earth obliquely downward, about

* Aranea nidulans. *Linn. Gmel.*

three inches in length, and one inch in diameter; this cavity she lines with a tough, thick web, which, when taken out, resembles a leathern purse; but, what is most curious, this house has a door with hinges, like the operculum of some sea shells; and herself and family, who tenant this nest, open and shut the door whenever they pass or repass.

In some places in the forests of Java, the webs of spiders have been found, woven with threads of so strong a texture, as not easily to be divided without a knife.

Dampier informs us, that at Campeachy in New Spain, there "is a sort of spiders of prodigious size, some nearly as big as a man's fist, with long small legs, like the spiders in England. They have two fangs, each an inch and half long, and of a proportionable thickness, which are black as jet, smooth as glass, and at their small end as sharp as a thorn; these are not straight, but bending. Some persons wear them in their tobacco-pouches to pick their pipes with; others preserve them for tooth-picks, especially such as are troubled with the tooth-ach; for, if report may be trusted, they will expel that pain. The backs of these spiders are covered with a dark yellowish down, as soft as velvet. Some say they are venomous, and others that they are not; but which of these accounts is to be credited I cannot determine."

OF THE SCORPION TRIBE.*

Scorpions may be considered as the most malignant and poisonous of all known insects. The poison is emitted

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* The Scorpions have eight legs, besides two claws, not unlike those of a crab, situated on the fore-part of the head, that serve the

through three very small foramina or holes in the sting, one on each side of the tip, and the other on the upper part. In California there is a species, the *Scorpio Americanus*, which is eaten by the inhabitants.

These animals prey on worms and insects, and frequently even on one another. The offspring are produced from eggs, of which one female lays a considerable number. After their appearance, they seem to undergo no further change than perhaps casting their skin from time to time, in the same manner as the spiders.

THE COMMON SCORPION *.

In some parts of Italy and France these animals are among the greatest pests that can plague mankind; but in those countries of the East, where they grow to a foot in

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purposes of hands. They have also eight eyes, three of which are placed on each side of the thorax, and two in the middle. On the anterior part of the head they have two short claw-like feelers; but no antennæ. And on the under side, between the breast and the abdomen, are two instruments, that have somewhat the resemblance of a comb. The tail is long, jointed, and terminated by a sharp, crooked string, from whence is emitted a pungent liquid, not dangerous, except in the very hot climates.

* Description. This, like other Scorpions, has a distant resemblance in shape to the lobster, but is infinitely more ugly. The head appears, as it were, jointed to the breast; and the mouth is furnished with two jaws, the under one of which is divided into two, and the parts, notched into each other, answer the purpose of teeth in breaking the food. On each side of the head there is a four-jointed arm, terminated by a claw, somewhat like that of a lobster. The belly is divided into seven segments, from the lowest of which the tail commences: this, in the present species, is armed with a hard, pointed, and crooked sting, the poison of which is very powerful.

Synonyms. Scorpio Afer. *Linn.*—Le Scorpion d'Afrique. *Tigny.*

length, there is no removing a piece of furniture without danger of being stung by them. There, we are told, they are full as bulky as a small lobster.

Many experiments have been made at different times to ascertain the strength of the poison; and in warm climates it has uniformly been found fatal to the smaller animals. To man the wound is extremely painful. The place becomes inflamed, and the surrounding parts often turn livid, and require to be carefully dressed in order to prevent mortification.

We are informed, that when a Scorpion is surrounded by burning coals or wood, so as not to be able to escape, it will strike its sting into its own body and destroy itself: but this seems to be merely a legend, undeserving of belief.

M. Navarette says, that when he was in the Phillippine Islands, he was instructed in an infallible preservative against the sting of Scorpions. The reader will smile when he is told that this was, when he went to bed, simply to make a commemoration of St. George. "I continued," says he, "this devotion many years; and, God be praised, the saint always delivered me, both there and in other countries, from those and such like insects." He, however, afterward observes, that he used another preventative, that of rubbing his bed all round with garlic, to keep them at a distance. The same credulity that dictated to him the commemoration of St. George, taught him, that the *moisture from a hen's mouth* was an excellent remedy.

This creature, which is but too common about old houses, and in dry or decayed walls, in all hot countries, is extremely bold and watchful. At the approach of an enemy it seldom exhibits any signs of fear, but, with its tail erect, and sting in readiness, as if fully confident in the force of its poison, it waits the attack with courage and

intrepidity, and seldom desists till either it is killed or its foe is put to flight.

OF THE CRAB TRIBE*.

These animals live chiefly in the sea; some, however, inhabit the fresh waters, and a few live in a great measure on land. They feed variously, on aquatic or marine plants, small fish, molluscæ, or dead bodies. The females carry their ova under their tail, which, for that purpose, in many of the species, is much broader than that of the males.

Those which are emphatically denominated *Crabs* have a short, flat tail, bent close to the body in a hollow betwixt the legs.

The *Hermit-crabs* have a soft tail, without any crustaceous covering, which the animals fit into empty shells, or hollow stones.

In the *Lobsters* the tail is the principal part of the body, being a very strong member, employed with great advantage both in swimming and leaping. This is formed of six convex segments, lying over each other somewhat like the tiles of a house, and terminated by five laminæ, or thin plates. The former are united by loose membranes, which admit of much motion. At the angle, where the upper and lower parts join, these segments are furnished with a kind of crustaceous fins, bordered with hair, and consisting of several articulations, called by naturalists *pedes natatorii*. The fins are moved, backward and forward, and a little outward and inward, by small muscles, contained within each articulation. By means of these it is that the animals

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* All the animals of this tribe have their bodies covered with a hard and strong shell. The head is united to the thorax or breast without any joint.

have their progressive motion at different depths in the water.

Most of the Crabs have eight legs, (a few, however, have six or ten,) besides two large claws which serve the purposes of hands. They have two eyes, situated on tubercles projecting from the head, and moveable in any direction. When the extremities of these are viewed with a glass, they are found to be composed of a multitude of lenses, like the eyes of insects. For a sense of touch they are furnished with antennæ, and palpi, or feelers. They have likewise a heart, with arterial and venous vessels, and branchiæ or gills for respiration. Their jaws are transverse, strong, and numerous; and the stomach is furnished with internal teeth.

THE LAND CRAB*.

The Land Crabs are natives of the Bahamas, and of most of the other islands between the tropics.—They live in the clefts of rocks, the hollows of trees, or in holes which they dig for themselves in the mountains. About the months of April and May in every year, they descend in a body of some millions at a time to the sea-coast, in order to deposit their spawn, and at this season the whole ground seems alive with them. They march in a direct line to their place of destination, and are said seldom to turn out of

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* DESCRIPTION. The largest of these animals measure about six inches across the body. They vary in colour, but are commonly of a blackish violet: some are entirely black, others yellow, or red, and others variegated. They are distinguished from other species of Crabs by having the first joint of the legs spinous, and the second and third furnished with tufts of hair.

SYNONYMS. Cancer Ruricola. *Linn.*—Violet Crab.—Ocypode Ruricule; Ocipoda Ruricula. *Latreille.*

their way on account of intervening obstacles. Even if they meet with a lofty wall, or a house, they will attempt to scale it. If they arrive at a river, they wind along the course of the stream.

They are as regular in their procession as an army under the direction of an experinced commander, being generally divided into three battalions. The first of these consists of the strongest males, which march forward to clear the route and face the greatest dangers. The main body is composed of females, which are sometimes formed into columns fifty or sixty yards broad, and three miles deep. The first division is often obliged to halt from want of rain, and the females never come from the mountains until the rains have set in for some time. Three or four days after these, the rear-guard follows, a straggling, undisciplined tribe, consisting of males and females, but neither so robust nor so vigorous as the former.

They proceed chiefly in the night; but if it rain during the day, they always profit by it. When the sun is hot they invariably halt till the evening. When terrified they run back in a confused and disorderly manner, holding up and clattering their nippers, with a threatening attitude; and if they are suffered to catch hold of the hand, they will sometimes tear off a piece of the skin. If in their journey any one of their body is so maimed as to be incapable of proceeding, some of them always fall upon and devour it. They march very slowly, being sometimes three months or upward in gaining the shore.

When arrived at the coast they prepare to cast their spawn: for this purpose they go to the edge of the water, and suffer the waves to wash twice or thrice over their bodies. They then withdraw, in order to seek a lodging upon land. In the mean time the spawn is excluded in a bunch from the body, and adheres to the under parts of the tail. This bunch becomes as large as a hen's egg, and exactly

resembles the roe of a herring. In this state they again, for the last time, seek the shore, and, shaking off the spawn into the water, leave it to the heat of the sun, to be brought to maturity. About two-thirds of the eggs are devoured by the fish which annually frequent the shores in expectation of this prey. Those that escape are hatched under the sand; and, not long after this, millions of the little Crabs may be seen quitting the shore, and slowly travelling up to the mountains.

The old ones, in their return, are feeble, lean, and so inactive, that they are scarcely able to crawl along; and their flesh at this time changes its colour. Many of them are obliged to continue in the level parts of the country till they recover, making holes in the earth, which they block up with leaves and dirt. In these they cast their old shells, and continue nearly motionless for six or seven days, when they become so fat as to be delicious food. After this they march slowly back to the mountains.

They subsist on vegetables, and, except when impelled by the desire of bringing forth their young, seldom venture out from their mountainous retreats. At this season the inhabitants of the islands where they are found wait in eager expectation for their descent, and destroy thousands of them; they disregard the bodies, and take only the spawn that lies on each side of the stomach within the shell, about the thickness of a man's thumb. The animals are much more valuable for eating on their return, after they have cast their shells. They are taken in the holes; and also sought for by night, when on their journey, by the light of flambeaux. The instant the Crabs perceive themselves attacked, they throw themselves on their back, and with their claws pinch most dreadfully whatever they happen to fasten on. But the crab-catcher seizes them by the hinder legs, in such manner that the nippers cannot touch him. They are caught in their holes by the sea-side,

by so fixing a stick as to prevent their escaping: and soon afterward the tide enters the holes, and the animals are drowned. Wafer says, that the inhabitants of some of the Caribbee islands, when they have caught them, put them for three or four days into a piece of potatoe ground, in order to render them more firm, and better eating.

THE COMMON OR BLACK-CLAWED CRAB*.

The most remarkable circumstance in the history of these animals, is the changing of their shells and broken claws. The former, as it is stated, is done once a year, and that usually between Christmas and Easter. During the operation they retire among the cavities of rocks and under great stones; and Dr. Darwin says (from the authority of a friend who had been engaged in surveying the sea-coasts) that a hard-shelled Crab always stands sentinel to prevent the sea insects from injuring the rest in their defenceless state; and that, from his appearance, the fishermen know where to find the soft ones, which they use for baits in catching fish; adding that, though the hard-shelled Crab, when he is on duty, advances boldly to meet the foe, and will with difficulty quit the field, yet at other times he shows great timidity, and is very expeditious in effecting his escape: if, however, he be often interrupted, he will pretend death, like the spider, and watch an opportunity to sink himself into the sand, keeping only his eyes above.

In the under part of the shell a crescent-formed suture may be observed, which opens at the casting of the shell, and leaves a space sufficient for drawing out the whole body. The thorax soon afterwards drops its breast-plate, and then the legs quit their crustaceous coverings. The

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* SYNONYMS. Cancer pagurus. *Linn.*—Eatable Crab.—Crabe pagure. *Latreille.*

body is now only enveloped in a soft skin, not unlike wet parchment; and the animal is so helpless as, for a while, t be incapable of motion, but lies between the rocks until it has acquired sufficient strength and hardness to bear the weight of its body, and convey itself from place to place, to perform its usual functions. The old shell is left, in two divisions, one that covered the body, and the other that enclosed the legs. Dr. Darwin asserts, that the stomach and intestines are also cast with the skin; and that the first food the animal takes, after recovering its strength, is the old stomach. It sometimes happens that the shell hardens prematurely, and fixes the animal a prisoner in his crevice; for fishermen have often found them thus immured. When crabs are out of health, they do not change their shells regularly, the old shells always remaining till they have recovered their proper strength and vigour.

When the fishermen take a Crab that is not in good condition, they return it into the sea, and sometimes mark it on the back with a sharp-pointed instrument, or the end of a knife; and it is very surprising that this mark may not only be seen to remain on the old shell, but that it is also found impressed on the subsequent new one. These men also say that, when Crabs have had their shells marked, and have been carried out to the distance of two or three miles, and thrown among others, they will always find their way back again: this the men have often observed, by afterward catching them in their former haunts.

When the claw of a Crab is bruised it bleeds, and the animal seems, by its motions, to experience much pain. For a while it moves it from side to side; then, holding it perfectly steady in a direct position, the claw on a sudden gives a gentle crack, and the wounded part drops off, not at the joint, as hath been generally said, but in the smoothest part of the limb; "just (says Mr. Collinson) as one sees the neck of a retort separate when it has been

heated by a red-hot iron ring, on the application of cold water." If, however, the wound happen to be at the extremity of the claw, the animal is said generally to bleed to death, or to pine away in consequence of the slow and almost insensible leaking of the vital moisture.

Crabs are naturally quarrelsome, and frequently have serious contests by means of those formidable weapons, their great claws. With these they lay hold of their adversary's legs, and wherever they seize, it is not easy to make them forego their hold. The animal seized has, therefore, no alternative but to leave part of the leg behind in token of victory.

Mr. Collinson was shown an experiment, to prove the extremely tenacious disposition of the Crab. A fisherman, by irritation, made a Crab seize one of its own small claws with a large one. The foolish creature did not distinguish that it was itself the aggressor, but exerted its strength, and soon cracked the shell of the small claw. Feeling itself wounded, it cast off the piece in the usual place, but continued to retain the hold with the great claw for a long time afterward.

Fishermen say that the Crab will live confined in a pot or basket for several months, without any other food than what is collected from the sea-water, and that even in this situation it will not decrease in weight.

This species of Crab is found on the rocky coasts both of Europe and India; and is the same that is introduced to our tables, being in greater esteem as food than many others of the tribe.

THE HERMIT CRAB*.

Having no shell to any part but its nippers, the Hermit Crab supplies by art what is denied to it by nature: for,

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* DESCRIPTION. The Hermit Crab is usually about four inches long. It has no shell behind, but is covered down to the tail with a

taking possession of the deserted shell of some other animal, it occupies that, till, by becoming too large for its habitation, it is under the necessity of changing it.

It is curious enough, in some countries, to observe this animal busily parading the sea-shore, along that line of pebbles and shells, which is formed by the furthest wave; still, however, dragging its old incommodious habitation at its tail, unwilling to part with one shell, even though a troublesome appendage, till it can meet with another more convenient. It stops first at one shell, turns it, passes by; then goes to another, contemplates that for a while, and, slipping its tail from the old habitation, tries on the new. This also is found inconvenient, and it quickly resumes the old one. In this manner it frequently changes, till at length it finds one light, roomy, and commodious. To this it adheres, though the shell be sometimes so large as to hide both the body and claws of the animal.

But many trials and many combats are sometimes to be sustained by the Hermit Crab, before he is thus completely equipped: for there is often a contest between two of them for some favourite shell. They both endeavour to take possession. They strike with their claw, and bite each other, till the weakest is compelled to yield. The victor then takes possession, and in his new acquisition parades backward and forward on the strand, before his envious antagonist.

That the ancients were well acquainted with the manners of the Hermit Crab, is evident from the following lines, translated from Oppian.

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rough skin, terminating in a point. It is armed with two strong, hard nippers before, one of which is as thick as a man's thumb, and so strong as to be capable of inflicting a very severe wound.

SYNONYMS. Cancer Bernhardus. *Linn.*—Pagure Bernard. *Latreille.*—Pagurus Bernhardus. *Fabricius.*

The Hermit-fish, unarm'd by nature, left
Helpless, and weak, grow strong by harmless theft.
Fearful they stroll, and look with panting wish
For the cast crust of some new-covered fish;
Or such as empty lie, and deck the shore,
Whose first and rightful owners are no more.
They make glad seizure of the vacant room,
And count the borrow'd shell their native home;
Screw their soft limbs to fit the winding case,
And boldly herd with the crustaceous race.
Careless they enter the first empty cell;
Oft find the plaited whelk's indented shell;
And oft the deep dy'd purple forc'd by death
To stranger fish the painted home bequeath.
The whelk's etch'd coat is most with pleasure worn,
Wide in extent, and yet but lightly borne.
But when they growing more than fill the place,
And find themselves hard-pinch'd in scanty space,
Compell'd they quit the roof they lov'd before,
And busy search around the pebbly shore,
Till a commodious roomy seat be found,
Such as the larger shell-fish living own'd.
Oft cruel wars contending Hermits wage,
And long for the disputed shell engage.
The strongest here the doubtful prize possess,
Power gives the right, and all the claim possess.

When this animal is caught, it emits a faint cry, but pinches forcibly with its claws; nor is there any mode of getting disengaged from these, but by either breaking them off, or heating the shell. It feeds on fish and insects.

THE LOBSTER *.

Lobsters are found on most of the rocky coasts of Great Britain. Some are caught with the hand, but the greater

* SYNONYMS. Cancer gammarus. *Linnæus.*—Astacus marinus. *Fabricius.*—Ecrevisse homard, in France.

quantity in *pots;* a sort of traps formed of twigs, and baited with garbage. These are formed like a wire mouse-trap, so that when the Lobster gets in there is no return. They are fastened to a cord sunk into the sea, and their place is marked by a buoy.

These animals are extremely prolific. Dr. Baster says he counted 12,444 eggs under the tail of a female Lobster, besides those that remained in the body unprotruded. They deposit these eggs in the sand, where they are soon hatched.

Like the rest of their tribe, they are said annually to cast their shells. Previously to the putting off their old one, they appear sick, languid, and restless. They acquire an entirely new covering in a few days; but during the time that they remain defenceless, they seek some lonely place, lest they should be attacked and devoured by such of their brethren as are not in the same weak situation.

At the same time that they cast their shell, they change also their stomach and intestines. The animal, while it is moulting, is said to feed upon its former stomach, which wastes by degrees, and is at length replaced by a new one.

Like some of the Crabs, these animals are said to be attached to particular parts of the sea.

In shelly armour wrapt, the Lobsters seek
Safe shelter in some bay, or winding creek;
To rocky chasms the dusky natives cleave,
Tenacious hold, nor will the dwelling leave.
Nought like their home the constant Lobsters prize,
And foreign shores and seas unknown despise.
Though cruel hand the banish'd wretch expel,
And force the captive from his native cell,
He will, if freed, return, with anxious care,
Find the known rock, and to his home repair;
No novel customs learns in different seas,
But wonted food and home-taught manners please.

The pincers of one of the Lobster's large claws are furnished with knobs, and those of the other are always serrated. With the former it keeps firm hold of the stalks of submarine plants, and with the latter it cuts and minces its food very dexterously. The knobbed or numb claw, as the fishermen call it, is sometimes on the right, and sometimes on the left side, indifferently. It is more dangerous for a person to be seized by the cutting claw than the other; but, in either case, the quickest way of getting disengaged from the creature is to pluck off its claw.

In casting their shells, it is difficult to conceive how the Lobsters are able to draw the flesh of their large claws out, leaving the shells of these entire and attached to the shell of the body; in which state they are constantly found. The fishermen say, that previously to the operation the Lobster pines away, till the flesh in its large claw is no thicker than the quill of a goose, which enables it to draw its parts through the joints and narrow passage near the trunk. The new shell is membranaceous at first, but it hardens by degrees. Lobsters only grow in size while their shells are in a soft state.

In the water these animals are able to run nimbly upon their legs or small claws; and, if alarmed, they can spring, tail foremost, to a surprising distance, almost as swiftly as a bird can fly. The fishermen can see them pass about thirty feet, and, by the swiftness of their motion, it is supposed that they may go much further. When frightened, they will spring from a considerable distance to their hold in the rock; and, what is not less surprising than true, will throw themselves into their hold in that manner, through an entrance barely sufficient for their bodies to pass; as is frequently seen by the people who endeavour to catch them at Filey Bridge, near Scarborough.

The circumstance of Lobsters losing their claws at thunder-claps, or on the sound of cannon, is well-authen-

ticated; and the fishermen are often jestingly threatened with a salute by the sailors. The restoration of claws thus lost may always be observed; for these never again grow to their former size. When the claws of Lobsters become inconvenient, from being by any means injured, they always break them off.

Lobsters are caught in such plenty on the coast of Northumberland, that, about the year 1769, the sum paid for the annual exports from Newbiggin and Newton, by the sea, (exclusive of those from Holy Island, which produce annually a very considerable sum,) amounted to nearly 1500*l.* This circumstance was stated by John Creswell, Esq. of Creswell, who, for many years, had made the payments for them from one fishmonger in London, on whose account all the most valuable fish from the coast of Northumberland were shipped.

THE PRAWN *, AND SHRIMP †.

Amongst sea-weed, and in the vicinity of rocks at a little distance from the shore, Prawns are found to be the most

* DESCRIPTION. The Prawn has a long horn in front of its head, compressed vertically, serrated both above and below, and bending somewhat upward. The thorax is smooth. The claws are small. The intermediate antennæ on each side are treble.

SYNONYMS. Cancer Squilla. *Linn.*—La Crevette ou Salicoque. *Cuvier* —Palæmon Squille. *Tigny. Latreille.*—Pandle, in some parts of England.

† DESCRIPTION. The Shrimp is considerably smaller than the Prawn. In place of the horn above-mentioned, it has two thin, projecting laminæ. The claws have a single, hooked, moveable fang. The intermediate antennæ on each side are only double.

SYNONYMS. Cancer Crangon. *Linn.*—Le Cardon. *Cuvier.*—Crangon Vulgaire. *Tigny. Latreille.*

abundant. They seldom enter the mouths of rivers; but, on the contrary, they have been caught on the surface of the sea, over thirty fathoms depth of water. Their usual mode of swimming is on their backs; but when threatened with danger, they throw themselves on one side, and spring backward to very considerable distances. They feed upon all the smaller kinds of marine animals, which they seize and devour with great voracity. In their turn, they are the prey of numerous species of fish, although the sharp and serrated horn in front of their head constitutes a very powerful weapon of defence against the attacks of all the smaller kinds.

Being in great request for the table, they are eagerly sought after by the fishermen, who catch them either in osier baskets, similar to those employed in catching lobsters, or in a kind of nets, called *Putting-nets*. These, which are well known to all frequenters of the sea-coasts, are five or six feet in width, and flat at the bottom; and are pushed along in the shallow water, upon the sandy shores, by a man who walks behind. When fresh, the colour of the Prawn is somewhat cinereous; but, when boiled, it changes to a beautiful light red.

At the side of the head there is frequently to be observed a large and unnatural lump. This, if examined, will be found to contain, under the thoracic plate, a species of crustaceous animal, which occupies the whole cavity, and which is there fed, and perfects its growth. It is described very minutely by my friend Col. Montagu, in the Linnean Transactions, and is denominated by him *Oniscus Squillarium**; but it is made to constitute a distinct genus by the

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* Col. Montagu says respecting it, "The most incurious person cannot but have noticed the tumour so common on the thorax of the Prawn or Shrimp, during the summer months, that is occasioned by the lodgment of this animal, whose growth occasions the distortion

French naturalist Latreille, who calls it *Bopyrus crangorum*.

The *Shrimp* is much smaller than the Prawn, and is by no means so much esteemed as food. It frequents sandy sea-shores in great abundance, and not unfrequently enters harbours, and even the ditches and ponds of salt-marshes. Its habits and economy are, in most respects, similar to those of the Prawn.

THE COMMON OR FRESH-WATER CRAW-FISH *.

In the breaking of the claw of the common Craw-fish, it has been observed that, in about a day or two after the piece is cast off, a red membrane, not unlike a bit of red cloth, closes up the aperture. This is at first plain; but, in the course of four or five days, it assumes a convexity, which gradually augments until it takes the appearance of a small cone, of about a line in height. It continues, however, to stretch out, and in ten days is sometimes more than three lines, or about a quarter of an inch high. It is not hollow, but filled with flesh, and this flesh is the basis

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of the shell. This tumour forms a secure asylum for the production of the more than usually soft and membranaceous bodies of the parasitical *Onisci*.

"That an insect so extremely common, and obvious to the most cursory observer, should not have found a place in the *Systema Naturæ* of Linnæus, appears very extraordinary; and I have been induced to describe it, because it seems to have been omitted by even the more modern systematists; or is certainly misplaced, and not where it ought to be.

"The male, which has hitherto escaped observation, is probably very minute."

* Synonyms. Cancer astacus. *Linn.*—Astacus fluviatilis. *Fabricius.*—Ecrevisse de rivière, in France.

or rudiment of a new claw. The membrane that covers the flesh performs the same office to the young claw as the membranes do to the fœtus of the larger animals. It extends in proportion as the animal grows; and, as it is tolerably thick, we can perceive nothing but a lengthened cone. When fifteen days are elapsed, this cone inclines toward the head of the animal. In a few days more its curvature increases, and it begins to assume the appearance of a dead claw. This claw, though at the end of a month or five weeks it has acquired the length of six or seven lines, which is more than half an inch, is still incapable of action. The membrane in which it is enclosed, becoming gradually thinner in proportion as it extends, gives an opportunity of observing the parts of the claw, and we now perceive that this conical substance is not a simple congeries of flesh. The moment is now arrived when the claw begins to be brought forth. The membrane at last bursts, and the new claw, though still soft, appears without incumbrance or investment. In a few days more it is covered with a shell; and, though still delicate, and not the half of its former length, it is able to perform all the natural functions. It has likewise been discovered that, whether the claw has been lopped off at the fourth articulation, or any where else, the animal, in a short time, recovers all that it had lost. The same reproduction takes place also in the horns; but, if the tail is cut off, the animal survives a few days only.

Craw-fish are found in many of our rivers, lodged in holes which they form in the clayey banks; and their presence is generally esteemed an evidence of the goodness of the water. They are frequently caught by means of sticks split at the end, with a bait inserted in the cleft, and stuck in the mud at the distance of a few feet from each other. These sticks, after remaining some time, are taken up, generally with an animal adhering to each. They are

gently drawn out of the mud, and a basket is put under them to receive the animals, which always drop off when brought to the surface of the water.

OF THE SCOLOPENDRÆ, OR CENTIPEDES, IN GENERAL.

These animals live chiefly on insects, and inhabit decayed wood, or hollows under stones. Those that frequent the hot climates are large, and many of them very venomous.

All the species have tapering antennæ, and two thread-shaped feelers united between the jaws. The body is long, depressed, and consists of numerous transverse segments; and there are as many legs on each side as there are segments of the body.

THE GREAT CENTIPEDE *.

None of the Insect tribe, the Scorpions excepted, are so formidable in appearance as the Centipede. It is found in the East and West Indies, and in various parts of Africa, inhabiting chiefly the woods, where it is preyed upon by the different species of snakes. It is, however, sometimes found in houses, and is said to be so common in particular

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* DESCRIPTION. The Scolopendræ vary greatly both in size and colour. Some of them are of a deep reddish brown, others of a yellow ochre colour, livid yellow, or tinged with red; and they are sometimes seen above a foot in length: they are, however, generally much less. Their legs terminate in very sharp hooks, or nails, of a shining black colour; and all the other legs are furnished with smaller ones of the same kind.

SYNONYMS. Scolopendra morsitans. *Linn.*—Great Scolopendra. *Shaw's Nat. Mis.*—Centipee, in the West Indies.—La Scolopendre mordante. *Tigny.*

districts, that the inhabitants are obliged to have the feet of their beds placed in vessels of water, in order to prevent their being annoyed during the night by these horrible reptiles.

Gronovius says, that all the legs of this detestable animal are venomous; but its most formidable weapons are the two sharp and hooked instruments, that are placed under the mouth, with which it destroys its prey. At the extremity of each of these there is a small opening, and from thence extends a tube, through which it is supposed the Centipede emits the poisonous fluid into the wound inflicted by these fangs.

Leeuwenhoek, desirous of ascertaining the influence of the poison, placed a large fly within the reach of a Centipede. He seized it between a pair of the middle feet, then passed it from one pair to the next, till it was brought under the fangs; which were plunged into its body, and it died instantly. St. Pierre says that, in the Isle of France, his dog was bitten by one of them that was upwards of six inches in length, and that the wound turned to a kind of ulcer, which was three weeks in healing. He was highly diverted in observing one of them overcome by a vast number of ants, that attacked it in conjunction, and, after seizing it by all its legs, bore it along, as workmen would have done a large piece of timber. Its poison is not more injurious than that of the scorpion, and seldom proves fatal to the larger animals.

Sir George Staunton says, that such was the horror excited in the minds of some of Lord Macartney's train, by the sight of these creatures in China, that many thought them alone a sufficient objection to the country.

WORMS*.

Intestinal Worms†.

OF THE ASCARIDES IN GENERAL‡.

ALTHOUGH these Worms have long been known to inhabit the stomach and intestines of men and animals, their origin and history seem enveloped in great obscurity. The difficulty of making satisfactory observations, and the want of favourable circumstances under which to attend to them, have hitherto presented insuperable obstacles to an intimate knowledge of their habits and economy.

In structure they are very simple, for, being intended to subsist on already digested food, they are not provided with any complicated organs. The denomination of Ascaris has been given to them from the circumstance of their being almost constantly in motion§.

Some of the species are oviparous, and others produce living offspring.

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* For an account of Worms in general, see vol. i. p. 48.

† In the Linnean order of *Intestina*, the animals are simple, naked, and without limbs.

‡ The body of these Worms is cylindrical, semi-transparent, and attenuated at each extremity. The head is furnished with three small vesicles. The intestines are generally spiral, and of a whitish colour.

§ From the Greek word ασκαριζειν *salire*.

THE LUMBRICAL* AND VERMICULAR ASCARIS†.

In the intestines of thin persons, the former of these Worms are frequently found. They are most abundant about the *ileum*, but sometimes ascend into the stomach, and even creep out at the mouth and nostrils. It does not often happen that they descend into the large intestines, except on the exhibition of medicines which increase the action of the intestines. When very numerous they give rise to unpleasant, and sometimes even to fatal disorders.

They are supposed to fix themselves by the three tubercles at the anterior extremity of their body, whilst they suck the nutritive juices, on which they are supported, through a small triangular aperture, which is situated in the centre, betwixt these tubercles. Their interior organization appears to consist only of a simple intestine, composed of a fine and very delicate membrane, which is always filled with an orange-coloured liquor.

The motion of these Worms is serpentine, and in no respect resembles that of the Earth-worm, with which they have sometimes been ignorantly confounded. The latter has the power of contracting and extending its body,

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* DESCRIPTION. The length of the Lumbrical Ascaris, is from twelve to fifteen inches. Its body is semi-transparent, and of a light yellow colour. The head is slightly incurved, with a transverse contraction beneath; and the mouth is triangular.

SYNONYMS. Ascaris lumbricoides. *Linnæus.*—Ascaride lombrical. *Bosc. Cuvier.*

† DESCRIPTION. This Worm is usually about half an inch in length, somewhat dilated in the middle of the body, and wrinkled at the sides. The head is subulate, and the tail tapers to a fine point. It is of a whitish colour.

SYNONYMS. Ascaris vermicularis. *Linnæus.*—Ascaride vermiculaire. *Bosc. Cuvier.*

whilst the length of the Ascaris is never diminished. The head is always thrown forward, by the Worm curling itself into circles, and suddenly extending it with considerable force.

These Worms are oviparous.

The *Vermicular Ascarides* are very common in the intestines of children. They are mostly confined to the rectum and colon; but are often found in the cæcum and small intestines, and even in the stomach. Their number exceeds all bounds, and they cause a most unpleasant sensation of itching, by piercing the skin in a slight degree, with their awl-shaped tails. Even newly born children are not always free from them.

They are viviparous. The female has, at the distance of about an eighth of an inch from the head, a small punctiform aperture, through which the offspring are protruded. Dr. Hooper, in the Memoirs of the Medical Society of London, informs us, that he has seen upwards of a hundred young ones escape through this aperture, all alive, and vivacious several hours after the death of the mother.

The present species are sometimes known by the appellation of *maw* or *thread-worms*.

OF THE FASCIOLÆ OR FLUKE-WORMS.

Fluke-worms are oftentimes very numerous in the viscera of quadrupeds, birds, fishes, and reptiles. They are found in the stomach, the intestines, and the liver. Each individual has both the sexes united in itself. They are oviparous, and the ovaries are lateral.

Their body is oblong and flattish, and is furnished with two orifices, one of which is situated at the anterior extremity of the body, and the other at a little distance beneath

it. Their interior represents an intestinal canal, which, after passing round the body, folds upon itself, and terminates at the second orifice.

THE FLUKE-WORM OF THE SHEEP *.

The livers of sheep which have fed in wet and marshy grounds, generally abound with these Worms. They are also occasionally found in the stomach and intestines; and, as it has been stated, are sometimes vomited up in brooks where the animals drink. Whilst they are in small numbers, the animal feels, or at least appears to feel, no inconvenience from them; but when they fill the biliary ducts, as they oftentimes do, the parts become swollen, and they become the source of fatal maladies. The disease called the *rot*, is supposed to be occasioned by them.

These Worms are occasionally found in the livers of other quadrupeds besides sheep.

OF THE TÆNIÆ, OR TAPE-WORMS†.

Tæniæ are worms that inhabit the bodies of different animals, where they are destined to feed upon juices

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* Description. This Worm is about an inch in length, and of a somewhat ovate form. The anterior part of the body is terminated by a small tube. It has a white line down the middle, and a spot in the centre of the body.

Synonyms. Fasciola hepatica. *Linnæus.*—Fasciole hépatique. *Bosc.*—La Douve du Foie. *Cuvier.*—Flounders, in some parts of England.

† The body is flat, and composed of numerous articulations; and the head has four orifices for suction, a little below the mouth, which is terminal, and continued by a short tube into two ventral canals. The mouth is generally crowned with a double series of retractile hooks or holders.

already animalized. They are generally found in the alimentary canal, and usually about the upper part of it, where there is the greatest abundance of chyle, which seems to be their natural food.

We are not to suppose that these worms are created for the purpose of producing disease in the animals they inhabit, but rather that nature has directed that no situation should be vacant, where the work of multiplying the species of living beings could be carried on. By thus allowing them to exist within each other, the sphere of increase is considerably enlarged. There is, however, little doubt, that worms, and more especially those of the present tribe, do sometimes produce diseases in the bodies they inhabit: but we are at the same time very certain, that worms do exist abundantly in many animals, without at all disturbing their functions, or annoying them in the slightest degree: and we ought to consider all these creatures rather as the concomitants than the causes of disease.

The species of Tæniæ are not confined *singly* to particular animals: men are subject to several different species, and even the people of particular countries and climates are subject to particular species of them. The people of England have the *Tænia Solium*, or Common Tape-worm, and rarely any other: the inhabitants of Switzerland the *Tænia lata*, &c.

These creatures are apparently possessed of few senses. Nothing resembling brain or nerves has been discovered; but as they are highly sensible to stimuli, it is most reasonable to conclude, that they have a considerable portion of nervous matter in the composition of their bodies: that is, of such matter as is susceptible of stimuli. Indeed, we can scarcely conceive how any animal can even exist without such matter in its composition. Having no particular organs of sense, the touch is therefore the only evident source of intelligence which they possess.

The mode of increase or propagation of Tæniæ, appears to be principally by ova; and there is reason to believe that these ova, as well as those of other intestinal worms, are so constructed, as not to be easily destroyed. From this circumstance we may suppose them to pass along the circulating vessels of other animals. We cannot easily explain the phænomena of worms being found in the eggs of fowls, and in the intestines of a fœtus before birth, except by supposing their ova to have passed through the circulating vessels of the mother, and been by this means conveyed to the offspring.

THE COMMON TAPE-WORM*.

The head of this animal is furnished with a mouth, and with an apparatus for giving it a fixed situation. The body is composed of a great number of distinct pieces articulated together, each joint having an organ, by means of which it attaches itself to the inner coat of the intestine; and as these joints are sometimes exceedingly numerous, so of course will be the different points of attachment. The joints nearest the head are always small, and they become gradually enlarged as they are further removed from it, except towards the tail, where a few of the last joints become again diminished. The body is terminated by a small semi-circular joint, which has no opening.

The external parts are clothed with a fine membrane-like cuticle, immediately under which is a thin layer of fibres, lying parallel to each other, and running in the direction of the length of the animal's body. In this direction all its motions are performed; from whence we may conclude that these fibres perform the office of muscles.

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* Synonyms. Tænia solium. *Linnæus.*—Tœnia cucurbitain. *Bosc.*—Le Cucurbitain. *Cuvier.*—Tape-worm.

The head has a rounded opening at its extremity, which is considered to be the mouth. This opening is continued by a short duct into two canals, which pass round every joint of the animal's body, and convey the aliment. The head is fixed to its place by means of two small tubercles, concave in the middle, that seem to serve the purpose of suckers. The alimentary canal passes along each side of the animal, sending a cross canal over the bottom of each joint, which connects the two lateral canals together. The internal structure of the joints is partly cellular, and partly vascular: the substance itself is white, and in its texture somewhat resembles the coagulated lymph of the human blood.

The food of the Tæniæ, requiring probably very little change before it becomes a part of their body, is taken in at the mouth, and, being thrown into the alimentary canal, is made to visit, in a general way, every part. The central structure of the vessels placed in each joint, seems calculated to absorb the fluid from the alimentary canal, for the purpose of sustaining and repairing the immediately adjacent parts: but there is in their bodies much cellular substance, into which no vessels enter. Such parts of the bodies of these animals, are possibly nourished by transudation of the alimentary fluid into their cells; or this may be effected by the capillary attraction of their fibres. As they have no excretory ducts, the decayed parts of their bodies are most probably dissolved into a fluid, which transudes through the skin like perspiration, and with this view the skin is extremely porous.

The length of the present Tænia is generally from three to thirty feet; but it has been known to reach sixty feet, and to be composed of several hundred joints.

When these worms produce a diseased state of body, those remedies (as drastic purges) are supposed to be the most effectual, that operate partly by irritating the exter-

nal surface of their bodies, so as to make them quit their hold, and partly by violent contractions in the intestines, which may sometimes divide their bodies, or even destroy them by bruising*. Electrical shocks, passed frequently through the abdomen, it is supposed, might be beneficial, as the lower orders of animals are in general easily destroyed by electrical shocks.

In injecting these Tæniæ with coloured size, in order to preserve them, three feet in length, from the head downwards, has been filled by a single push with a small syringe; but the injection would not pass from below upward beyond the joint, owing, as it is supposed, to a valvular apparatus, situated in the lateral canals, immediately below the places where the cross canals are sent off.

OF THE FILARIÆ, OR THREAD-WORMS†.

These troublesome animals are found in the bodies of several kinds of quadrupeds, birds, and insects. Most of the species perforate the skin, immediately under which they lodge themselves; a few, however, have been discovered in the intestines. None of them have yet been found to infest the bodies of reptiles or fish.

THE INDIAN THREAD-WORM, OR GUINEA-WORM‡.

This species is too commonly found both in the East and West Indies. It enters the naked feet of the slaves,

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* There is, however, reason to suppose, that merely breaking them, unless the detached part comes immediately away, will not be altogether effectual, as this is generally understood to be capable of producing a new head, and thus becoming an independent animal.

† Their body is round, thread-shaped, and very smooth. The mouth is dilated, and has a roundish concave lip.

‡ DESCRIPTION. This worm is of a yellowish white colour,

and occasions very troublesome itchings, and sometimes excites even fever and inflammation. It particularly attacks the muscles of the arms and legs, from whence it is only to be extracted by means of a piece of silk or thread tied round its head. But the greatest caution is necessary in this simple operation, lest the animal, by being strained too much, should break; for, if any part remain under the skin, it grows with redoubled vigour, and becomes a cruel and sometimes a fatal enemy.

Dampier tells us, that these worms are no thicker than a large brown thread, but, as he had been informed, are five or six yards long. "If they are broken in drawing out, that part which remains in the flesh will putrefy, be very painful, and endanger the patient's life, or at least the use of the limb; and I have known some that have been scarified and cut strangely to take out the worm." He was unfortunate enough to have one of these creatures in his own ankle. "I was (he says) in great torment before it came out: my leg and ankle swelled, and looked very red and angry, and I kept a plaister to bring it to a head. At last, drawing off my plaister, out came about three inches of the worm, and my pain abated presently. Till that time I was ignorant of my malady, and the gentlewoman at whose house I was, took it for a nerve; but I knew enough what it was, and presently rolled it up on a small stick. After that I opened the place every morning and evening, and strained it out gently, about two inches at a time, not without some pain, till at length I had got out about two feet." He afterwards had it entirely destroyed

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and frequently ten or twelve feet in length, although its thickness is not greater than that of a horse-hair.

SYNONYMS. Filaria Medinensis. *Linn. Gmel.*—Gordius Medinensis, *Linn. Syst. Nat.*—Dragoneau de Médine. *Bosc.*—Le Ver de Médine. *Cuvier.*

by one of the negroes, who applied to it a kind of rough powder, not unlike tobacco-leaves dried and crumbled very small.

M. D'Obsonville received in his right leg the germ of one of these worms. He observed that its head was of a chesnut colour, and that to the naked eye it appeared to terminate in a small black point. On pressing it a little with a pin, and examining it with a common magnifying glass, he fancied he perceived something like a little trunk or tongue, capable of being pushed out or contracted. The body was not thicker than a strong thread; but, when the animal was extracted, it was found to be of the length of two or three ells. It appeared to be formed of a series of small rings, united to each other by an exceedingly fine membrane, and a single intestine extended through the body. This worm was extracted in the usual way; and the reason he gives for the injury done by breaking these animals is, that they are full of a whitish acrimonious lymph, which immediately excites inflammation, and not unfrequently produces afterward an abscess or gangrene. A worm in his leg was twice broken, and twice occasioned an abscess. At last, at his own request, the part affected was rubbed with a preparation of mercury: and in eight or ten days the effect surpassed his hopes; for not only the body of the insect came away in suppuration, but the wound, which was then more than three inches long, and considerably inflamed, was in this time almost entirely healed.

OF THE FURY TRIBE.

Of this tribe only one species has hitherto been discovered. The body is linear, and of equal thickness throughout. It has on each side a single row of close-pressed reflected prickles.

THE INFERNAL FURY *.

In Finland, Bothnia, and the northern provinces of Sweden, the people were often seized with an acute pain, confined to a mere point, in the face, or other exposed part of the body, which afterwards increased to a most excruciating degree, and sometimes, even within a few hours after its commencement, proved fatal. This disorder was more particularly observed in Finland, especially about marshy places, and always in autumn. At length it was discovered, that the pain instantly succeeded something which dropped out of the air, and almost in a moment penetrated and buried itself in the flesh. On more accurate attention, the Fury was detected as the cause. It creeps up the stalks of sedge-grass and shrubs in the marshes, whence it is often carried off by the wind; and if the naked parts of the skin of any person happen to be directly in its course, it immediately adheres and buries itself within. The first sensation is said to be like that arising from the prick of a needle. This is succeeded by a violent itching of the part; soon afterwards by acute pain, a red spot, and gangrene, and at last by inflammatory fever, accompanied with swooniugs. In the course of two days at the furthest, death follows, unless the worm be extracted immediately; which is very difficult to be done. The Finlanders say, however, that a poultice of curds or cheese, will allay the pain, and entice the animal out. Perhaps the most effectual method is, carefully to dissect between the muscles where it had entered, and thus extract it with the knife.

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* Description. This worm is about half an inch in length, and of a carnation colour, often black at the apex.

Synonyms. Furia infernalis. *Linn.*—La Furie. *Cuvier. Bosc.*

Linnæus, as he was once collecting insects, was stung by a Fury in so dreadful a manner, that for a little while there was great doubt whether he would recover.

OF THE GORDIUS, OR HAIR-WORM TRIBE.

These animals are inhabitants chiefly of stagnant waters. In their organization and structure they are extremely simple. Their bodies are round, thread-shaped, equal in thickness throughout, and smooth; and their interior consists of a canal, which extends from one extremity to the other.

THE COMMON HAIR-WORM*.

The popular name of this worm originated in the notion, that it was produced from the hair of horses and other animals; a notion that is even yet prevalent among the lower classes of the people. Its Linnæan name of *Gordius* originated in the habit that it has of twisting itself into such peculiar contortions, as to resemble a complicated gordian knot. In this state it often continues for a considerable time, and then slowly disengaging itself, extends its body to the full length.

It is common in our fresh waters, and particularly in such where the bottom is composed of soft clay, through which it passes with the greatest facility.

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* Description. This worm is about the thickness of a horse's hair, and, when full grown, is ten or twelve inches in length. Its skin is somewhat glossy, and of a pale, yellowish white, except the head and tail, which are black.

Synonyms. Gordius aquaticus. *Linn.*—Water Hair-worm. *Barbut.*—Dragoneau aquatique. *Bosc.*—Le Dragonneau des Ruisseaux. *Cuvier.*

Sometimes it moves in the water with a tolerably quick undulating motion, like that of a leech; and at other times its motions are the most slow and languid imaginable. When the water in which it swims happens to be dried up, it soon loses every appearance of life; the slender body shrivels, and it may be kept in this state for a great length of time. But whenever it is put into water its body soon re-assumes its former appearance; in less than half an hour it begins to move, and, in a few minutes more, it is as brisk and active as ever. The Abbé Fontana kept a Hair-worm in a drawer for three years, at the expiration of which time it was perfectly dry and hard, and exhibited no signs of life; but, on putting it into water, it soon recovered its former vigour. When kept in a vessel of water, it will sometimes appear motionless, and as if dead, for several hours, and afterward will resume its former vigour, and seem as healthy as before.

It is stated, that the bite of this worm has been known to produce the complaint called a *whitlow*. This is mentioned by Linnæus as a popular opinion in Sweden, and, since his time, the fact has been confirmed by various other persons.

The Hair-worm is sometimes found in the earth as well as in water; and particularly in gardens of a clayey soil, after rain.

THE SEA LONG-WORM *.

Such is the length of these very extraordinary worms, that it is almost impossible to fix any bounds to it. The

* DESCRIPTION. The thickness of this worm is from that of a quill, nearly to that of the little finger. It is generally of a dusky brown colour, with a tinge of green. Five lines of a paler colour extend through its whole length.

SYNONYMS. Gordius marinus. *Montagu. Linn. Tran.*—Lineus longissimus. Black Line Worm. *Sowerby's Brit. Misc. p. 15. Pl. 8.*

fishermen of the Devonshire coast, after telling one that they are many fathoms long, and that, although they are continually hawling them up from the deep, as they would a rope, they never find the extremity, they are satisfied that the enquirer knows enough of the matter; and, in many cases, neither money nor persuasion will induce them to procure specimens of them.

Some of the most intelligent of the fishermen, however, assert, that they are upwards of thirty yards in length; but Colonel Montagu is of opinion, that as many feet must be the utmost. None of the specimens which he saw appeared to exceed twenty feet.

The largest of these worms are taken by dredging. They are also sometimes found under the stones at low water, but always coiled up or contorted in a most complicated manner.

The expansion and contraction of the Long-worms are very surprising. One which was supposed to be nearly eight feet in length, on being put alive into spirits, instantly contracted to about twelve inches, at the same time increasing to double its preceding bulk. It is very difficult to preserve them perfect without contraction. If suffered to die in their natural element, one part will decay and become putrid, whilst the other remains entire and capable of motion; and the addition of any thing offensive instantly produces contraction.

They are found on the coasts of Devon and Cornwall; and are also frequently dredged up by the fishermen in the Forth of Forth, Scotland.

*OF THE LUMBRICUS, OR EARTH-WORM TRIBE**.

Some of these worms bore into the earth, others live in mud, and others in the sand of the sea-shores. They are

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* The Earth-worms have a round, annulated body, with generally

furnished with numerous prickles, which are short, and curved backward. These aid their movements in the ground. Their bodies, likewise, are covered over with a viscid matter, which transudes from numerous pores, and which also assists their progress.

THE DEW-WORM*, AND LUG-WORM†.

The most insignificant insects and reptiles are of much more consequence, and have much more influence in the economy of nature, than the incurious are aware of; and notwithstanding their minuteness, are mighty in their effects, from the circumstance of their numbers and fecundity. Dew-worms, though in appearance a small and despicable link in the chain of nature, yet, if lost, might make a lamentable chasm. For, to say nothing of half the birds and some quadrupeds that are supported by them, worms seem to be the great promoters of vegetation. This they do by boring, perforating, and loosening the soil, and rendering it pervious to rains and the fibres of plants, by drawing straws and stalks of leaves and twigs into it; and, most of all, by throwing up such infinite

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an elevated, fleshy belt near the head. Most of the species are rough, with minute concealed prickles, situated longitudinally, and have in the body a lateral aperture or pore.

* Description. The Dew-worms have a prominent, annulated belt, at about one-third of their length. The fore part of the body is cylindrical, and the rest depressed. They are of a red colour, and furnished with eight lines of prickles.

Synonyms. Lumbricus terrestris. *Linn.*—Lob-worm, Garden-worm, or Twatchel.—Le Lombaie terrestre. *Cuvier.*

† Description. This worm differs from the preceding chiefly in having two papillæ at the back of each segment of its body, bearing a small bristle in each.

Synonyms. Lumbricus marinus. *Linnæus.*

numbers of lumps called worm-casts, which form a fine manure for grass and corn.

Gardeners and farmers express their detestation of worms; the former, because they render their walks unsightly, and make them much work; and the latter, because they think worms eat their green corn. But these men would find that the earth without worms would soon become cold, hard-bound, and void of fermentation; and consequently steril. And besides, in favour of worms, it should be observed, that green corn, plants, and flowers, are not so much injured by them, as by many species of insects in their larva state: and by unnoticed myriads of those small shell-less snails, called slugs, which silently and imperceptibly make amazing havock in the field and garden.

Lands that are subject to frequent inundations are always poor: one great reason of this may probably be, because all the worms are drowned.

The body of the Dew-worm is formed of small rings, furnished with a set of muscles, which act in a spiral direction, and enable it, in the most complete manner possible, to penetrate into or creep upon the earth. The motion of these creatures may be explained by a wire wound on a cylinder; where, when one end is drawn on and held fast, the other, upon being loosed, will immediately follow. These muscles enable them with great strength to dilate or contract their bodies. The annuli or rings are also each armed with small, stiff, and sharp beards or prickles, which they have the power of opening out, or closing to their body. And under the skin is secreted a slimy matter, which they emit at the perforations between the rings, to lubricate the body, and facilitate their passage into the ground.

Dew-worms make their casts principally about the months of March or April, in mild weather.—In rainy

nights they travel about, as appears from their sinuous tracks, on a soft, muddy soil, perhaps in search of food. When they appear at night on the turf, although they considerably extend their bodies, they do not quite leave their holes, but keep their tails firmly fixed, so that, on the least alarm, they can precipitately retire under the earth. Whatever food falls within their reach, when thus extended, such as blades of grass, or fallen leaves, they seem content with it.

Helpless as they may appear, these creatures are very vigilant in avoiding such animals as prey upon them. The mole, in particular, they avoid by darting to the surface of the earth the instant they feel the ground move. Fishermen, who are acquainted with this circumstance, catch them in great numbers, by moving the earth in places where they expect to find them, with a dung fork. When, however, they are wanted for fishing, they are perhaps most easily caught by the light of a lantern in the night, after heavy showers, on grass walks and sheep pastures, where the herbage is short.

In winter these worms retire very deep into the earth, to secure themselves from being frozen. They do not become torpid during this season; for in the intervals of mild weather they are often observed to throw up their casts, in the same manner as at other times of the year.

Lug-worms are marine animals. They frequent those parts of sandy sea-coasts which are left dry by the ebbing of the tides. Here they bury themselves deep in the sand, throwing up a kind of hillock over their holes, in the same manner as the Dew-worms. The fishermen employ them as bait for whiting, cod, and other fish.

OF THE LEECHES IN GENERAL.

The body of the Leech is oblong and truncate, or appearing as if cut off at both ends. These animals are cartilaginous, and move by dilating the head and tail, and contracting themselves into the form of an arch.

Some species are viviparous: others are oviparous, laying their eggs on aquatic plants, or carrying them under their belly. Each egg contains many young ones. Several of the smaller kinds may be multiplied by cutting.

THE MEDICINAL LEECH *, AND HORSE LEECH †.

Stagnant ponds and ditches are the places where these animals are most commonly found. Their body is formed with numerous annular wrinkles, which they have the power of expanding or contracting at pleasure. The tail ends in a circular muscle or sucker, which, when applied to any substance, readily adheres, by the animal's drawing up the middle, so as to have it pressed firmly down by the external air. By this it fastens itself with ease and security, while it extends the other part of the body in any direction; and it is so firmly fixed, that it can move its head about to seek for nourishment, without any danger of being carried away by the strength of the current. When the Leech is

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* DESCRIPTION. This species is of an olive black colour, with six yellowish lines above, and spotted with yellow beneath. It is generally two or three inches in length.

SYNONYMS. Hirudo medicinalis. *Linn.*—La Sangsue des Chirurgiens. *Cuvier.*—Sangsue médicinale. *Bosc.*

† DESCRIPTION. The Horse-leech is of an olive-brown colour, with an ochry yellow margin on each side. It is paler beneath than above, and sometimes marked with a few black spots.

SYNONYMS. Hirudo Sanguisuga. *Linn.*—Sangsue noir. *Bosc.*

desirous of moving onward, it extends its body forward, fixes its head in the same manner that it did its tail; then loosens and draws that up; and again fastens it near its head, as a fresh point to proceed from.

The head of the Leech is armed with three teeth, of a slightly cartilaginous substance, which are so situated as to converge when the animal bites, and leave a somewhat triangular mark on the skin. These are sufficiently strong to pierce the skin of an ox or a horse. Through the holes it forms with them, it sucks the blood: this is done by contracting the muscles of the throat, so as to make the blood rush through the vacuum above the wound into the stomach, which is a kind of membranaceous receptacle, divided into twenty-four small cells. Here it sometimes remains for several months, almost without coagulating, and affords support to the animal during the whole time. It passes off by transpiration, the matter fixing on the surface of the body, and afterward coming off in small threads. In proof of this, if a Leech be immersed in oil, (where it will keep alive for several days,) and afterward put into water, a kind of slough will be seen to loosen from its skin, exactly of the shape of the body.

The poor people, in several parts of the South of England, collect Leeches for sale, and keep, for that purpose, several thousands together, in casks or tubs of spring water. This they change about twice every day; or, when in small quantities, about once in two days. They carefully wash away all the slime and filth which exude from their bodies. Violent noises are said to be very injurious to these animals; particularly thunder-storms, after which they oftentimes die in great numbers. The effluvia of drugs is said also to be hurtful to them.

It is stated, that a large-sized Leech will generally draw about an ounce of blood. These animals will sometimes adhere so long, and become so distended, as afterwards to

die in consequence. They are, at any time, easily loosened from the skin, by putting upon them salt, pepper, or acids.

The Leech is a viviparous animal, producing one young at a time, and this about the month of July. If confined in a glass, and kept in a room, it is said to show itself very restless before a change of weather.

Horse-leeches are equally, if not more, abundant in ditches and stagnant waters, than the former species. They are so extremely greedy of blood, that a vulgar notion is prevalent, that nine of them are able to destroy a horse. Medical men, in general, are cautious not to use them, from an opinion, though probably a very groundless one, that their bite is noxious.

Molluscous Worms*.

OF THE SLUGS IN GENERAL†.

Few animals, for their size, are more voracious than these. They would do serious injury to our fields and gardens, were not their numbers abridged by several of the smaller quadrupeds, and by various species of birds.

They have so strong a tendency to reproduction, that, if the head or tail be cut off, these parts will grow again. Most of the species can exist for a great length of time, even for several months successively, without food.

THE SMALL GRAY SLUG ‡, AND BLACK SLUG §.

In moist gardens, meadows, fields, and woods, the former of these Slugs is but too common. Its time of going abroad

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* The Linnean order *Mollusca* consists of all those simple animals which are without shells, and are furnished with tentacula or arms. The greater part of them are inhabitants of the sea.

† The body of the Slug is oblong, and has on its upper part a kind of fleshy shield; and below a flat, longitudinal disk, by means of which the animal has its progressive motion. On the right side of the body there is an aperture. Above the mouth are situated four tentacula, or feelers, at the apex of each of the two larger of which there is an eye.

‡ Description. The usual length of this Slug is from half an inch to an inch. It is of a grayish white colour, with a yellowish shield. The tentacula are black.

Synonyms. Limax agrestis. *Linn.*—Spinning Limax. *Linn. Tran.*—Spinning Slug.—Limace agreste. *Bosc.*—La Petite Limace grise. *Cuvier.*

§ Description. This species is from one to three inches in

in search of food is in the evening and night. During the day it lies concealed, either among the leaves of vegetables or under the surface of the ground. Its progress on the ground may easily be traced by the slime which it leaves behind. Few animals are more destructive to vegetation than these. When touched with the finger they draw in their tentacula, and appear as if dead.

These Slugs sometimes suspend themselves by a kind of thread, formed from the viscid substance which covers their bodies.

About the year 1789, Mr. Hoy observed, in a plantation of Scotch firs, something hanging from one of the branches, which, as it seemed uncommon, he approached, and found to be this animal. It was hanging by a single line, or thread, attached to its tail. This was, upward, very fine; but near the animal it became thicker and more broad, till at length it exactly corresponded with the tail. The Slug was about four feet below the branch, and nearly at the same distance from the ground; which it gradually approached at the rate of an inch in about three minutes *.

The line by which it descended was drawn from the slimy exudation gradually secreted from the pores that covered its whole body. A great degree of exertion seemed necessary to produce a sufficient supply of the liquid, and to force this toward the tail. It alternately pushed out and drew back its head; and turned it as far as possible, first to one side, and then to the other, as if thereby to press its sides, and thus promote the secretion.

This is the substance of Mr. Hoy's account. Dr. Latham

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length. Its body is black, furrowed, and wrinkled. The shield is whitish, and rough with numerous dots.

SYNONYMS. Limax ater. *Linn.*—Limace noire. *Bosc. Cuvier.*

* It has been observed by Dr. Latham to descend about three inches and a half in a minute.

says that the secretion from which the thread is formed, is wholly from the under parts of the animal, and not from the back or sides, both of which, during the operation, appear nearly dry. That it did not proceed from any orifice in the tail was evident; for, in some experiments, the animal was suspended by the tip, and at other times from the side, a full eighth of an inch from the tip. The flow of the viscous secretion toward the tail appeared to be excited by means of an undulating motion of the belly, similar to that of crawling.

After having spun for some time, the power of spinning seems, for a while, to be lost: but in those Slugs on which experiments have been made, it has always been recovered, after their being kept some hours among wet moss.

The *Black Slug*, or Snail, is a well-known inhabitant of our fields and meadows, during the summer season. The country people consider its appearance as an indication of approaching rain; but this is rather to be accounted for by the moisture of the ground and the plants at the time, as it is seldom indeed to be observed abroad during very dry weather. It feeds on the roots and leaves of different kinds of plants.

OF THE APLYSIA TRIBE.*

The species of Aplysia, (or Laplysia, as it stands, by a typographical mistake, in the Systema Naturæ,) are only three in number. One of them inhabits the European seas, another the shores of Barbary, and the third the coasts of America.

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* The body is covered with reflected membranes. There is a shield-like membrane on the back; and in the right side an aperture. The vent is on the extremity of the back. These animals have four feelers, resembling ears.

These animals respire water by means of branchiæ, which form a kind of tuft on the back, and which are covered with an operculum.

THE DEPILATORY APLYSIA*.

There is a general, though very unjust, prejudice against this animal. Pliny and Dioscorides each speak of its poisonous properties in strong terms. "To some, (says the former, by his translator, Philemon Holland,) it is a very poison, if taken inwardly, either in meate or drink; to others againe, the aspect and sight thereof is venomous. The same creature is hurtfull, even in the sea, if it be touched onely. Neither is there any living creature that feedeth upon this fish, but it dieth thereupon, unlesse it be the Sea Barbell onely; and all the harme that this fish catcheth by eating of it is this, that the flesh is the more tender. If a man or woman chance to be infected by eating of it, they presently smell and scent of the said fish; and this is the first sign and argument to prove that they be empoysoned thereby: howbeit, they die not immediately, but may continue so many daies as the said animal lived after it came out of the sea." It is generally supposed that the hair will fall off those parts of the body which are touched by these animals; and that they cause strangury to those who eat of them.

It is strange, observes Col. Montagu, that the poisonous touch and offensive smell which appear to have been the

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* Description. The body, which is, apparently, a shapeless mass, enveloped in a loose skin, folding over and nearly meeting on the back, is of a pale lead-colour. The shield is circular, and on the middle of the back. This animal is from two to five inches in length.

Synonyms. Laplysia depilans. *Linn.*—Laplésie dépilante. *Bosc*

origin of the name of this Aplysia, should, without reason, have been handed down to posterity, and that a most unmerited opprobrium should have so long been fixed upon one of the most harmless and inoffensive creatures. On the coast of Devon, this gentleman has had frequent opportunities of handling these animals, which he has invariably done with impunity: they neither affect the hand nor the olfactory nerves; but are as destitute of smell as they are of any depilatory power.

Like the cuttle-fishes, they are furnished with a reservoir, which is filled with a dark-coloured fluid, and which they also employ in concealing themselves from the attacks of their enemies. This fluid leaves a beautiful purple stain, and is discharged in such quantity, that it might possibly be turned to some advantage in dyeing, if a method could be devised to fix it.

They inhabit those parts of the sea where the bottom is muddy, in the neighbourhood of rocks and sea-weeds. Their food consists chiefly of small crabs and shell-fish. They have three strong and muscular stomachs, with pyramidal, bony processes, somewhat resembling those so well known in the lobster.

OF THE AMPHITRITES IN GENERAL.*

There is no tribe of marine animals whatever that exceed these in beauty. They inhabit tubes of horny or tendinous substance, the greater part of which is buried in the sand,

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* The body of these animals is annulate, and projects from a tube. At its anterior extremity there are tentaculæ, which, when expanded, are arranged like radii from the centre of a circle, and in two divisions. On each side of the body, through its whole length, there is a row of minute peduncles, or feet.

or mud, at the bottom of the sea. From the upper extremity of these, they push out a great number of elegant tentacula, which are arranged about the mouth like rays from the centre of a circle.

The spécies are numerous; and several beautiful kinds have, of late years, been discovered to inhabit the English coasts.

THE FUNNEL-SHAPED *, AND VOLUTACORN AMPHITRITE †.

Each of these singular and extremely beautiful animals, is of late acquisition to the Natural History of the British Islands; and, for the discovery of them, in the neighbourhood of Kingsbridge, Devon, we are indebted to the indefatigable researches of Col. Montagu.

The former inhabits a case or tube of a gelatinous, but firm and elastic, nature. These cases are buried beneath

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* Description. The body is long, and consists of from a hundred and fifty, to a hundred and sixty joints. These are distant, and of an orange colour, annulate with whitish. At the base of the tentacula there is a scalloped membrane. The tentacula are two in number, semicircular when spread, and nearly uniting into a regular circle: they are each composed of about thirty-seven rays, connected by a transparent web, except at the points. Their outside is smooth, and of a purple colour. The inside is most elegantly ciliated with two rows of fimbriæ along each ray, of a chesnut-colour, shaded to a purple near the centre. The mouth is purple, and the lips are bordered with chesnut.

Synonym. Amphitrite infundibulum. *Montagu, in Linn. Tran.*

† Description. The length of this species is about five inches, and the tentacula are somewhat more than an inch long. The stem is furnished with long ciliated fibres on one side. The plumes of the tentacula are of a light yellowish brown, banded and mottled with chesnut.

Synonym. Amphitrite volutacornis. *Montagu, in Linn. Tran.*

the surface of the sand; and, when uncovered, as they sometimes are, by the lowest ebb of the spring tides, their situation is only discoverable by a small portion of them above, appearing not unlike a black jelly. When the tide returns, the animals display their beautiful tentacula, but rarely expose their body. If dug up, and confined in a glass of sea-water, they sicken in the course of a few days; and, if the water be not changed, they soon evacuate their tubes and die.

In their native abode, observes Col. Montagu, (in the Linnean Transactions,) they recede on the least alarm; and when the gelatinous case is taken in the hand, and the animal is extended within it, the sudden contraction, within the tremulous tube, produces a singular and instantaneous vibrative shock to the parts in contact, which, from its being unexpected, creates surprise.

They are found in the Estuary of Kingsbridge, near the Salt-stone, but are by no means of frequent occurrence there.—Their food is supposed to consist of the smaller species of marine worms. These they guide towards their mouth by a whirling motion, which they make by means of their tentacula.

The *Volutacorn Amphitrite* was taken in the sea near Kingsbridge, in the dredges which are employed for the catching of oysters. The specimen described by Col. Montagu was brought to him alive, in sea-water. In this situation he had an opportunity of examining carefully the curious structure of its beautiful tentacula, which, he says, far exceed, in delicacy, the finest pencil of the artist. They are not retractile, but are capable of greater or less extension.

It has not hitherto been ascertained whether this tribe of animals have the sexes in two individuals, or whether they

are confined to one. Their interior conformation appears to consist chiefly of a stomach and three tubes, similar to intestines, of which one appears to perform the functions of the heart, or at least to form the principal centre of their vascular system.

*OF THE NEREIS TRIBE**.

These are all marine animals. They are very various in size; some are invisibly minute, whilst others are several inches in length. They have been denominated Marine Scolopendræ or Centipedes; and, in some respects, bear a strong resemblance to these animals.

By means of the numerous legs with which they are furnished, they are enabled to move about amongst the submarine rocks and stones, with considerable agility. Under these they conceal themselves, and lie in ambush for their prey, which chiefly consists of minute worms of different kinds.

THE PELAGIC NEREIS†.

The animals of this species reside at the bottom of the sea, among the roots of sea-weeds, concealed beneath

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* The animals of this tribe are long and slender. Their feet are very numerous, and arranged on each side of the body. They have, in general, two or four eyes, but some of the species have none. Their feelers are simple, and placed above the mouth.

† Description. This species is usually about seven inches in length. The back is convex, and has a scarlet line down the middle. Between the eyes there is a triangular white spot, and there are two others at the sides. The body is of a tawny colour; and the peduncles, or feet, are cirrate and warty.

Synonyms. Nereis pelagica. *Linnæus*.—Néréïde pélasgienne. *Bosc*.

stones, and in empty shells. Here they sometimes spin a kind of silken net. They also bury themselves in the sand, occasionally lining their holes with the same substance. In the places of their concealment they lie in wait for prey, darting the anterior part of their body suddenly out, as it passes them, and seizing it in their powerful jaws.

If one of these animals be cut into two or three parts, the fragments will continue to move for a considerable time afterwards. They, however, all die, except that part to which the head is attached: this recovers from the injury it has sustained, and becomes a perfect animal.

They are not very uncommon on the British coasts.

THE NIGHT-SHINING NEREIS*.

These minute creatures inhabit every sea; and are one of the causes of the luminous shining of the water in the night. They are found on all kinds of marine plants; but often leave them, and swim on the surface of the water. They are frequent at every season of the year, but particularly in summer, before stormy weather, when they become more agitated and more luminous than at other times. So small are they, that myriads of them may be contained in a small cup of sea-water. Innumerable quantities of them lodge in the cavities of the scales of fishes; and to them, probably, the fish may, in some measure, be indebted for their luminous quality. "I have observed with great attention (says Barbut) a fish just caught out of the sea,

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* DESCRIPTION. The Night-shining Nereis is oblong, linear, and so minute as to escape examination by the naked eye. The body, composed of about 23 segments or joints, is scarcely two lines long. It is quite pellucid, and its colour a water-green.

SYNONYMS. Nereis noctiluca. *Linn.*—La Néréïde phosphorique. *Cuvier. Bosc.*

whose body was almost covered with them, and have examined them in the dark. They twist and curl themselves with amazing agility, but soon retire out of our contracted sight; probably on account of their glittering numbers dazzling the eye, and their extreme minuteness eluding our researches. It is to be observed that, when the unctuous moisture which covers the scales of fishes is exhausted by the air, these animals are not to be seen; nor are the fishes then noctilucous, that matter being, perhaps, their nourishment when living, as they themselves afford food to many marine animals. They do not shine in the day-time, because the solar rays are too powerful for their light, however aggregate, or however immense their number."

Their appearance is particularly brilliant when the wind is in the east and south-east points; and in winter nights, preceded by a warm day. If water containing these animalcules be kept warm, they will retain their light two whole days after they are dead; but in cold weather they lose it in the course of seven or eight hours. Motion and warmth, which increase their vivacity and strength, increase also their luminous properties.

OF THE ACTINIÆ, or SEA-ANEMONES.*

These animals are of a somewhat oblong form, and, when closed, resemble a truncated cone. They are fixed by the base, and from the upper part of their body occasionally extend several tentacula, which are disposed in regular circles. The mouth is situated at the top, in the centre of the tentacula, and is furnished with crooked teeth.

They are all capable of varying their figure; but, when their tentacula are fully expanded, they have the appearance of full-blown flowers. Many of them are of very beautiful and brilliant colours. They feed on shell-fish and other marine animals, which they draw into their

mouth by means of their arms; and they eject the shells and other indigestible parts through the same opening. It sometimes happens, however, that a shell presents itself in a wrong position, and the animal is not able to discharge it in the usual manner: in this case, we are told that it is forced through the body, making a wound, as if with a knife, near the base. The arms seem to lay hold of objects by making a vacuum; for, on touching them with the fingers, they readily adhere, but no viscous matter is deposited by them. Their mouth is capable of great extension, so as to allow them to swallow very large shells without injury. The whole interior part of their body is one cavity or stomach. They have the power of progressive motion; but this is extremely slow, and is said to be performed by loosing their base from the rock, reversing their body, and employing their tentacula as so many legs.

Nearly all the animals of this tribe may be separated from their native rocks by means of a card carefully introduced beneath, so as not materially to injure them; and, being put into glass vessels with sea-water, which must be changed about once a week, they will there fix themselves, and may be kept alive and in full vigour for a great length of time, in places far distant from the sea-coasts.

All the species are viviparous.

THE COMMON, OR PURPLE SEA ANEMONE*.

On the submarine rocks of several of the European coasts, and on those of the British islands in particular, these animals are extremely abundant. They adhere by their base so firmly to the rocks, as frequently to be left

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* DESCRIPTION. The exterior of the body is smooth, and of a purple or dark red colour, sometimes striped with green. The tenta-

above water at the ebbing of the sea: but are generally found at some little depth below the surface. When closed, their form is that of a rounded cone, with an orifice at the top. This they can at pleasure either close entirely, or extend very wide, to admit their tentacula to spread out, and to receive such food as these draw into it. The tentacula, when fully expanded, somewhat resemble the petals of the red garden anemones. If any extraneous substance is introduced into the cavity of the mouth, or even if any of the tentacula are but slightly touched, the animal instantly contracts itself into a conoid shape, and swallows it.

If kept in a vessel of salt-water, they will continue to live and flourish for a considerable length of time. It is, however, remarkable, that when from want of the water being changed, they become unhealthy, they protrude their intestines at the mouth, and at length turn inside out, their mouth closing round the base. On renewing the water, they will oftentimes recover, and assume their natural shape and appearance.

These creatures occasionally assume many extraordinary shapes. When detached from the glass in which I have kept them, I have known them sometimes to appear as if composed of two small conjoined spheres, sometimes to become extended and nearly cylindrical, and sometimes to have a stricture below the orifice, at the upper part of the body, appearing as though it were tied tightly round with a slender string.

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cula are red; and round the mouth there is a row of small blue spots.

SYNONYMS. Actinia anemonoides? *Linnæus.*—Actinie pourpre. Actinia purpurea. *Cuvier.*

THE ROSE-COLOURED SEA ANEMONE*.

On this species the Abbé Dicquemaire made several experiments, to ascertain its powers of production, and some other very remarkable properties. He first cut off all the tentacula, which grew again in less than a month; and, on repeating this a second and third time, he had equal success. One of the animals had its upper part cut off: the base was found, a few days afterward, to have fallen from its place, but it soon entirely recovered its limbs. After cutting one of them in two, the Abbé offered a piece of a muscle to the detached part, and the limbs seemed eager to take it. They drew it into the mouth, and it was swallowed; but, as the body was wanting to receive it, the piece came out at the opposite end, "just (says the Abbé) as a man's head, being cut off, would let out at the neck the bit taken in at the mouth." It was offered a second time, and again received, and retained till the following day, when it was thrown up. In this manner it was fed for some time, the bits, when they did not pass through, appearing considerably altered on their re-appearance at the mouth.—If the base of any of the Anemones happened to be injured by the incision, the wound generally proved mortal.

On being put under the receiver of an air-pump, and having the air exhausted, these animals did not seem to

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* Description. When the tentacula are fully expanded, this beautiful species sometimes measures five or six inches across. These tentacula are of a pale rose colour. The mouth is also rose-coloured, but darker. When the animal is closed, its exterior is greenish, and covered with numerous warts.

Synonyms. Actinia rufa? *Linn. Gmel.*—Actinia equina. *Linn. Syst. Nat.*

experience any ill effects, or to perceive any difference betwixt this and their being in the open air: if their tentacula happened to be expanded, they remained so, and not the least shrinking could be perceived.

Some of them lived upwards of twelve months, without any other food than what the sea-water afforded them.

When shell-fish, or pieces of other fish, or bits of raw meet were offered, if not too large, they always seized them. The shells, even if closed, they ejected in the course of a day or two, but perfectly cleared of their contents.

They bring forth their offspring alive at the mouth; and the Abbé had these produced several times in his hands: they were generally from eight to twelve in number. Though some of them are at this time almost imperceptible, yet they immediately fix themselves, and expand their tentacula, in order to catch their prey.

These animals are destitute of eyes, yet they were always very evidently affected by light. If a candle was held over the glasses in which they were kept, and at such a distance as not to communicate any heat, they regularly closed, and did not again expand until the light was removed.

Among other experiments of the Abbé Dicquemaire, he gave to two Actiniæ of different species, a narrow slice of fish, so laid, that each had hold of an end. The yellow one, however, happened to seize the larger share. Each swallowed on by its respective end, till at length their mouths came in contact. The gray one seemed at first to get the better; but the other soon recovered its share, lost it again, and again recovered it. These alternate victories lasted about three hours, till at last, the gray one losing its hold, the other obtained the prize. This sucked it in but slowly, and the gray one again ventured its mouth upon a last tug at the end still within reach: but the effort

proved fruitless; the yellow companion gave a final pull, and swallowed the whole.

When the Sea Anemones are boiled in water, they acquire a firm consistence, and become a very palatable food. Cats are remarkably fond of them thus cooked. Their smell is not unlike that of a warm crab or lobster.

THE SEA MARIGOLD*.

Mr. Hughes, in his Natural History of Barbadoes, has given us a very accurate account of this species, several individuals of which were discovered in that island some years ago. He calls it an animal flower, and seems to consider it as a sensitive plant, having many animal properties.

" The cave which contained these animals was (he says) near the bottom of a rocky cliff facing the sea, in the north part of the island, in the parish of Saint Lucy. The descent to it was steep and dangerous, being in some places almost perpendicular. The cave contained a natural bason of water, about sixteen feet long, and twelve broad, in the middle of which was a rock almost covered with them.

" Round the sides of this, at different depths under the water, seldom, however, more than eighteen inches, were observed at all times of the year, seemingly fine radiated flowers, of a pale yellow, or a bright straw-colour, slightly tinged with green.—These had the appearance of a cir-

* Description. The stem of this species is sub-turbinate; and its disk is surrounded with petal-shaped tentacula or rays. The disk is furnished with four dark-coloured threads or arms, which close together like a forceps, and secure its prey.

Synonym. Actinia calendula. *Linnæus.*

cular border of thick-set petals, about the size of, and much resembling, those of the single garden marigold.

"I often attempted to pluck one of them from the rock to which they are fixed, but could never effect it; for, as soon as my fingers came within two or three inches of it, it would immediately contract and close together its yellow border, and shrink back into the hole in the rock; but, if left undisturbed for three or four minutes, it would come again gradually into sight, expanding, though at first very cautiously, what seemed its leaves, till at last it appeared in its former bloom: it would, however, again contract, with surprising quickness, when my hand approached within a little distance of it."

From the centre of the apparent flower proceeded four dark-coloured threads, somewhat resembling, says this gentleman, the legs of a spider. These, which were its arms or feelers, had a quick spontaneous motion from side to side.

Its body seemed to be a small dark-coloured tube, about as thick as a raven's quill, one end of which was affixed to the rock, and the other, which extended a little way from it, was encircled with the yellow border above-mentioned.

Soon after the discovery of these surprising animals, great numbers of people came to see them. This was attended with some inconvenience to the person through whose grounds they were obliged to pass, and he resolved to destroy the objects of their curiosity. That this might be done effectually, he caused all the holes, out of which the animals appeared, to be carefully drilled with an iron instrument. He could not, however, even by this means, destroy them; for in the course of a few weeks they again appeared in the very same places, and, in a short time, became as numerous as before.

OF THE SEPIA, OR CUTTLE-FISH TRIBE.

The structure of these animals is very remarkable. Their body is cylindrical, and, in some of the species, entirely covered with a fleshy sheath; in others, the sheath reaches only to the middle of the body. They have eight tentacula or arms, and in general two feelers, as they are called, which are much longer than the arms. Both the feelers and arms are furnished with strong circular cups or suckers. The mouth of these animals is hard, strong, and horny, resembling, both in texture and substance, the beak of a parrot.

In the back, under the skin, there is a kind of bone, composed of thin parallel plates, one above another, and separated by little columns, arranged in quincunx order. This bone is oval, thick toward the middle, and thin at the edge. It is extremely light, generally elastic, and in the living animal transparent like glass: the surface, in some species, is marked with longitudinal furrows.

THE OFFICINAL*, AND EIGHT-ARMED CUTTLE-FISH†.

By means of the numerous circular cups or suckers with which the arms of both these species are furnished, they

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* Description. The body is ovate, and surrounded by a margin, which is interrupted at the posterior part. There are eight short and pointed arms, and two tentacula, which are four times as long as the arms. These are rounded, and the tips are very broad, and furnished with numerous suckers.

Synonyms. Sepia officinalis. *Linn.*—Sèche Commune. *Bosc.* —La Seiche Commune. *Cuvier.*

† Description. The body is short, and rounded at the posterior part. There are eight arms, which taper to a point, and are

seize their prey, and firmly attach themselves to rocks or other hard substances. In order to do this, they apply the surface of the suckers, extended and plain, to the surface of the body to which they are about to adhere: then, drawing them up in the centre, by the muscles contrived for that purpose, a vacuum is formed, and they are fixed by the pressure of the external air.—The adhesive power is so great, that it is generally more easy to tear off the arms, than separate them from the substance to which they are fixed. If the arms happen to be broken off, they are soon afterward reproduced.

The beak of these animals is so strong and powerful, that they are enabled, by means of it, to break in pieces the shells of limpets, and of other marine testaceous animals, on which they feed.

In the belly not only of these, but of all other species of Cuttle-fish, there is a vessel that contains a quantity of dark or inky fluid, which the animal emits, on contraction, when alarmed.—This not only tinges the water so as to conceal its retreat, but is at the same time so bitter, as immediately to drive off its enemies.

> Th' endanger'd Cuttle thus evades his fears,
> And native hoards of fluid safely bears.
> A pitchy ink peculiar glands supply,
> Whose shades the sharpest beam of light defy.
> Pursu'd he bids the sable fountain flow,
> And, wrapt in clouds, eludes th' impending foe.
> The fish retreats unseen, while self-born night,
> With pious shade, befriends her parent's flight.

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joined at the base by a membrane or web, and covered on one side with two rows of alternate suckers. There are no pedunculated tentacula, as in the last species.

SYNONYMS. Sepia Octopus. *Linn.*—Sèche Octopode. *Bosc.*—Le Poulpe Commune. *Cuvier.*

Swammerdam was of opinion, that *Indian ink* was nothing more than this black fluid in an inspissated state, with the addition of perfumes. If Indian ink be dissolved in water in any considerable quantity, in the space of a few days it acquires a very high degree of putridity, clearly indicating its being formed of some animal substance; and no other seems so well calculated to compose it as this.

The male always accompanies the female, and when she is attacked, will brave every danger, and attempt her rescue, even at the hazard of his own life. As soon as she observes her partner to be wounded, she immediately escapes, her timidity not suffering her to afford him any assistance. When these animals are dragged out of the water, they make a noise somewhat like the grunting of a hog.

The young ones are produced from eggs deposited on the sea-weed, in parcels, those of the officinal species, exactly resembling a bunch of grapes. The eggs are at first white, but after their impregnation by the male, they become black: they are round, with a little point at the end, and in each of them is contained a Cuttle-fish, surrounded by a gelatinous fluid.

The Officinal Cuttle-fish has in its body a bone, which, when dried and pulverized, is employed by silversmiths for moulds, in which they cast their small work, as spoons, rings, &c. It is also converted into that useful article of stationery, called pounce. This bone, on account of its lightness, is sometimes called sea-foam, or sea-biscuit.

This species was in great esteem by the ancients as food, and it is even yet used as such by the Italians, and the inhabitants of other countries on the shores of the Mediterranean.

The *Eight-armed Cuttle-fish* in the hot climates, sometimes becomes of such a size, as to measure twelve feet

across its centre, and to have each of its arms between forty and fifty feet long. When the Indians go out in their canoes, in places frequented by these Sepia, they are always in dread of their flinging their arms over and sinking them; on which account they are careful to take with them an ax, to cut them off.

OF THE ASTERIAS, OR STAR-FISH TRIBE.

These are inhabitants of the sea, and are usually found on the sand, or among the rocks on the sea-shore, considerably below high water mark. Their covering is a coriaceous crust, which defends them from the attacks of the smaller animals; and they have five or more rays proceeding from a centre, in which their mouth is situated. Every ray is furnished with a prodigious number of tentacula, or short, soft and fleshy tubes, which appear to be of use not only in taking prey, and in aiding the motion of the animal, but also in enabling it to adhere to rocks and other substances, by which it withstands the force of the waves. In a single animal the tentacula have been found several hundred in number: and, when the Star-fish are thrown on their backs, these may be observed to be pushed out and withdrawn, in the same manner as snails do their horns. The progressive motion of the Star-fish, which is performed by the undulation of their rays, is very slow. They possess considerable powers of re-production: for, if a ray happen to be broken off, in the course of a short time a new one will appear. The mouth is armed with bony teeth, that are used in seizing and breaking the shells on which the animals feed: from hence a canal extends to each of the rays, runs through the whole length, and becomes gradually narrower as it approaches the extremity.

If the Star-fish are drowned in brandy or spirits of

wine, and the rays be kept flat and expanded during the time, it is easy afterwards to extract, by means of a pair of forceps, the stomach and intestines entire through the mouth. This information may be of use to those who wish to preserve specimens of them.

THE COMMON OR FIVE-RAYED STAR-FISH *.

In a large animal of this species, which I kept by me for some time alive, there must have been more than 4000 tentacula on the under sides of the rays. These the creature frequently retracted, and again pushed out, in the same manner as a snail does its horns. By means of these, it was enabled firmly to adhere to the dish of salt-water in which it was kept. Whenever I touched the tentacula with my finger, all those of that ray or limb were gradually withdrawn, but those of the other rays were not in the least affected by it.

It is stated, that these animals, which are extremely common in some seas, feed on oysters, and are consequently very destructive to them. This, however, if it relate to full-grown oysters, must be incorrect, since, when alive, the Star-fish are so soft and tender, that an oyster, in closing upon them, would either cut off their limb, or, at least, would injure it to such a degree, that when it next opened its shell, the animal would be glad to make its escape. Besides, the mouth of the Star-fish being in the centre of the under part of its body, I know not in what manner

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* Description. The rays are five in number, and each of them is angular. At the angles there are prickly protuberances. When alive they are usually of a brownish white colour. I have a specimen in my possession which is more than a foot in diameter.

Synonyms. Asterias glacialis. *Linnæus.*—Asterie glaciale. *Bosc.*

this could possibly come in contact with food defended by two such large and powerful shells as those with which the oyster is furnished. It has been said, that the tentacula are of use in taking this prey; but this, from their nature, must be entirely fabulous.

Like the other species, these animals breathe by means of a kind of branchiæ or gills, which consist of a fringed substance extended along each ray, and communicating above with the stomach. These all unite under a small circular and striated operculum, which may be observed on the back.

THE ARBORESCENT STAR-FISH*.

This extremely singular species is occasionally found in most seas, but never in great abundance. It has five equi-distant, thickly jointed processes, proceeding from its centre, each of which is divided into two other small ones, and each of these into two others still smaller; and this mode of regular subdivision is continued to a vast extent, and in the most beautiful gradation of minuteness, till at length the number of extreme ramifications sometimes amounts to several thousands. One specimen, that measured three feet across, had five hundred and twelve extremities to each ray; so that, in this, the whole number was 2560. By this most curious structure, the animal becomes as it were a living net, and is capable of catching such creatures as are by nature destined for its prey, by the sudden contraction of its innumerable ramifications; and the unfortunate object is secured by these, beyond all possibility of escape.

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* Synonyms. Asterias Medusæ. *Linn.*—Magellanic Star-fish. Basket-fish. Branched Asterias. Medusa Star-fish.

In order to preserve this curious animal whole and undamaged for cabinets, it should be taken far out in the sea; and the fishermen ought to be careful not to break off any of the limbs, and to prevent the animal from contracting and entangling its outer and most slender branches. The fishermen of the Cape of Good Hope get six, and sometimes even ten rix-dollars for one of these Star-fish.

When it is alive, or but just dead, its colour is a reddish or deep carnation; but, on being dried, it becomes somewhat gray. It should be dried in the shade, in some open place, where the wind has free access to it; for in the sun it is apt to dissolve, and if placed too much in the shade, it frequently becomes putrid.

OF THE ECHINUS, OR SEA-URCHIN TRIBE.

The Sea-urchins are generally round, and shaped like a somewhat flattened ball. Their exterior is a bony crust, usually furnished with moveable spines, by which they are defended from injury, and by means of which they have their progressive motion: these are often very numerous, amounting, in some species, to upwards of two thousand. The mouth is placed beneath, and, in most of the species, has five valves.

They are all inhabitants of the sea.

THE COMMON OR EATABLE ECHINUS*.

The spines with which the shell of this animal is covered, are the instruments by which it conveys itself at plea-

* DESCRIPTION. This animal, which lodges in cavities of rocks just within low-water mark, on most of the British coasts, is nearly of a globular shape, having its shell marked into ten partitions or

sure from one place to another; and by means of these it is enabled to move at the bottom of the water with great swiftness. It generally employs those about the mouth for this purpose, keeping that opening downward; but it is also asserted to have the power of moving forward, by turning on itself like a wheel. When any thing alarms these animals, they immediately move all their spines toward the object, and wait an attack, as an army of pikemen would with their weapons. The number of muscles, fibres, and other apparatus necessary to the proper management of these, are very great, and exceedingly wonderful. So tenacious are the Sea-urchins of the vital principle, that, on opening one of them, it is no uncommon circumstance to observe the several parts of the broken shell move off in different directions. The ancients, according to Oppian, gave credence to a circumstance much more wonderful than this:

Sea-urchins, who their native armour boast,
All stuck with spikes, prefer the sandy coast.
Should you with knives their prickly bodies wound,
Till the crude morsels pant upon the ground;
You may e'en then, when motion seems no more,
Departing sense and fleeting life restore.
If in the sea the mangled parts you cast,
The conscious pieces to their fellows haste;
Again they aptly join, their whole compose,
Move as before, nor life nor vigour lose.

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divisions, not much unlike those of an orange. The mouth is situated in the lower or under part, and armed with five strong and sharpened teeth. On the outside of the shell there is a prodigious number of sharp, moveable spines, of a dull violet and greenish colour, curiously articulated, like ball or socket, with tubercles on the surface, and connected by strong ligaments to the skin or epidermis with which the shell is covered.

SYNONYMS. Echinus Esculentus. *Linn.*—Eatable Echinus. *Penn.* —Common Echinus, or Esculent Echinus.—*Shaw's Nat. Mis.*

Between the spines, and disposed in a continued longitudinal series on the several divisions or regions of the shell, are an infinite number of very small foramina, communicating with an equal number of tentacula placed above them. They are possessed of a very high degree of contractile power, and are furnished at the extremities with an expansile part, which may be supposed to operate as a sphincter, or as the tail of a leech, in fastening the animals securely to rocks and other substances to which they choose to adhere.

In Marseilles, and some other towns on the continent, this species is exposed for sale in the markets, as oysters are with us, and is eaten boiled like an egg. It forms an article of food among the lower class of people who reside in the neighbourhood of the sea-coasts of many parts of this country, but does not seem to have made its way to the tables of the opulent. The Romans adopted it, and dressed it with vinegar, mead, parsley, and mint.

Testaceous Worms, or Shell-Fish*.

Multivalves.

OF THE LEPAS, OR BERNACLE TRIBE.

It is the nature of these animals to adhere in clusters to rocks, shells, the bottoms of ships, or floating pieces of wood.

The shells are fixed at their base by a long and flexible kind of neck, and consist of more than two unequal and erect valves. The animal that inhabits them is similar to one inhabiting submarine rocks, which Linnæus has placed amongst the *Mollusca,* under the name of *Triton.*

THE GOOSE-BEARING BERNACLE †.

These shells have long been known in consequence of a fabulous notion formerly prevalent, even amongst those who ought not to have been so deceived, that from them was bred a species of goose, common in some parts of our

* The Linnæan order *Testacea,* comprises all those Molluscous Worms which are covered with calcareous shells.

† Description. The shells of the Goose-bearing Bernacles have five smooth valves; the dorsal valve rounded at the sides, and slightly carinate. The shells are about an inch and half long, and the peduncle or neck two or three inches. The valves are yellow at the margins.

Synonyms. Lepas anatifera. *Linn.*—L'Anatife lisse. (Anatifa lævis.) *Cuvier. Bosc.*

island, called the Bernacle Goose*. Even of late years an attempt has been made to impose upon the credulity of the public, by an exhibition in London of a large collection of these shells, as those from which, as the advertisements stated, the Bernacle Geese were produced.

To the bottoms of ships, and to pieces of floating timber, these Bernacles are sometimes seen adhering in countless numbers. Colonel Montagu observed a piece of fir timber, above twenty feet long, which was drifted on the coast of Devonshire, and which, from end to end, was completely covered with them. They appear particularly to attach themselves to wood, where they cluster together of all sizes, the smaller adhering, by short pedicles, to the larger ones.

The animals contained in these shells, as well as in those of all the other species, have each twenty-four claws or tentacula, all joined in pairs near the bottom, and inserted in one common base. The twelve longest stand somewhat erect and arched, and arise from the back part of the animal. They appear like so many yellow curled feathers, clear, horny, and articulated. Every joint is furnished with two rows of hairs on the concave side. They are of use in catching prey, and the animals are continually employed in extending and contracting them for this purpose.

The twelve smallest are placed, six on each side, in front of these. They are more pliable and more thickly set with hairs than the others, and seem to perform the office of hands. The mouth, formed not unlike a contracted purse, is placed in front between the smaller claws; and within its folds are situated six or eight horny laminæ or erect teeth. Under this lie the stomach and intestines, and the tendons, by which the animal adheres to the shell.

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* See the account of this bird, in vol. ii. p. 330.

OF THE TEREDO TRIBE*.

There are not more than four known species of Teredo. Of these, two are found in holes, which they perforate in wood; a third, in the seed-vessels of a plant which grows in the East Indies, and called, by Linnæus, *Xylocarpum Granatum;* and the fourth, (the Gigantic Teredo,) in mud at the bottom of the ocean, on the coast of the island of Battoo, near Sumatra. The shells of the latter are sometimes betwixt five and six feet in length.

These animals were formerly arranged with the more simple of the univalve shells, but their proper place is certainly amongst the multivalves.

THE SHIP-WORM†.

Great numbers of these destructive worms, which are supposed to have been introduced from India into Europe, are sometimes found in the sides and bottoms of ships: so much so, as even to endanger their sinking.

By means of their hard and cutting jaws, they are able to penetrate into any timber, except such as is of an

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* The shell of the Teredo has two principal hemispherical valves, truncated and open at the end, and two small lanceolate accessory valves, remote. The hinge is furnished with a long incurved tooth in each valve. The tube in which the animal resides is testaceous, and somewhat cylindrical. The animal is an *Ascidia.*

† Description. This animal, when full grown, is in general from four to six inches in length, of a gray colour, and about the thickness of the middle finger. It is covered with a whitish, thin, cylindrical, and smooth shell; and has, in front of the head, two small hemispherical valves, flat before, and angular behind.

Synonyms. Teredo navalis. *Linn.*—Serpula Teredo. *Da Costa.* —Le Taret Naval. *Bosc.*

extremely hard and compact substance. They, however, bore as seldom as possible across the grain; for, after they have penetrated a little way, they turn, and continue with the grain tolerably straight, until they meet with another shell, or a knot. Their course then depends on the nature of the obstruction: if considerable, they prefer making a short turn back, in form of a syphon, rather than to continue for any distance across.

Col. Montagu states, that he had an opportunity of examining a great number of these shells in the Dock-yard at Plymouth, where every possible means have been tried to prevent the ravages which are committed by them. Although they have not been known in this country more than fifty or sixty years, they are now become naturalized to our climate, and have, of late, very considerably increased in numbers. Piles which had not been in the water more than four or five years, though of solid oak, were found, on examination, to be greatly perforated by them.

In the year 1730, the inhabitants of the United Provinces were under serious alarm concerning these worms, which had made dreadful depredations in the piles that support the banks of many parts of those coasts. One of the persons who had the care of the coasts at that time, observed, to his astonishment, that some of the timbers were, in the course only of a few months, made so full of holes, that they could be beaten to pieces with the least force.

Although, when the mud was scraped off, the perforations did not appear much larger than to admit a pin's head, yet the piles, on being split lengthwise, were found full of large passages, or hollow, cylindrical ducts, each of which contained a worm, enclosed in its testaceous tube, which it exactly filled.

The most efficacious method which has hitherto been discovered, to preserve timber from the ravages of these worms, is that which is now adopted in the Dock at Ply-

mouth, to cover all the parts which are under water with short, broad-headed nails. These soon cover the whole surface with a strong coating of rust, which is found to be altogether impenetrable to the animals.

*OF THE PHOLAS TRIBE**.

The animals of this tribe perforate clay, spongy stones, and wood, while very young; and, as they increase in size, they enlarge their habitation within, and thus become imprisoned. They are always found below high-water mark, and a mass of rock may sometimes be seen wholly perforated by them. They have two orifices, or openings, capable of elongation in the manner of a proboscis: one of these is supposed to be the mouth, and has the faculty of spouting water. Most of them contain a phosphorescent liquor, of great brilliancy in the dark, which also illuminates whatever it touches or happens to fall upon.

From the following species the character of nearly the whole tribe may be collected.

THE DACTYLE PHOLAS †.

The very extraordinary powers possessed by these animals, of penetrating into solid bodies, when compared with their apparent imbecility, have justly excited the astonishment of philosophers and naturalists in all ages. When

* The Pholas has a shell of two valves, that open widely at each end, with several lesser ones at the hinge. The hinges are folded back, and united by a cartilage; and in the inside, beneath the hinge, there is a long, incurved tooth. The animal contained in this shell is an *Ascidia*.

† Description. This is an oblong shell, marked with somewhat spinous stripes. When full grown, it is about an inch and a quarter

divested of their shell they are roundish and soft, with no instrument that seems in the least fitted for boring into stones, which they are known to do, or even for penetrating the softest substance. They are, indeed, each furnished with two teeth; but these are placed in such a situation as to be incapable of touching the hollow surface of their stony dwellings. They have also two corners to their shells, that open and shut at either end; but these are totally unserviceable to them as miners. The instrument with which they perform all their operations, and by means of which they bury themselves in the hardest rocks, is only a broad, fleshy substance, somewhat resembling a tongue. With this soft, yielding instrument, while yet young and small, they work their way into the substance of the stone, and enlarge their apartment as their increasing size renders it necessary.

The seeming unfitness, however, of these animals, for penetrating into rocks, and there forming a habitation, has induced many philosophers to suppose that they entered the rock while it was yet in a soft state, and, from the petrifying quality of the water, that the whole rock afterwards hardened round them by degrees. This opinion, however, has been confuted, in a very satisfactory manner, by Dr. Bohads, who observed that many of the pillars of the temple of Serapis, at Puteoli, were penetrated by these animals. Whence he justly concludes, that the Pholades must have pierced them after they were erected; for no workman would have laboured a pillar into form, if it had been honey-combed by worms in the quarry. In short, there can be no doubt but that the pillars were perfectly sound

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deep, and nearly five inches broad. It is of a whitish colour, and in its general external form has a distant resemblance to a muscle.

SYNONYMS. Pholas dactylus. *Linn.*—Pholade dactyle. *Bosc.*—Pholas muricatus. *Da Costa.*

when erected, and that these animals attacked them during the time in which they continued buried under water, after the earthquake that swallowed up the city.

From hence it appears that, in all nature, there is not a greater instance of perseverance and patience, than that which this animal is seen to exhibit. Furnished with the bluntest and softest augur, by slow successive applications, it effects what other animals are incapable of performing by force, penetrating the hardest bodies with only its tongue. When, while yet very small, it has effected an entrance and buried its body in the stone, it there continues, for life, at its ease; the sea-water that enters at the little aperture, supplying it with luxurious plenty. Upon this seemingly thin diet it by degrees grows larger and larger, and soon finds itself under the necessity of increasing the dimensions of its habitation and its shell.

The motion of the Pholas is slow, almost beyond conception; its progress keeps pace with the growth of its body; and, in proportion as it becomes larger, it makes its way further into the rock. When it has penetrated to a certain depth, it turns from its former direction and hollows downward; till at last, when its habitation is completed, the whole apartment resembles the bowl of a tobacco-pipe; the hole in the shank being that by which the animal entered.

Thus immured, the Pholas lives in darkness, indolence, and plenty; it never removes from the narrow mansion into which it has penetrated; and seems perfectly content with being enclosed in its own sepulchre. The influx of the sea-water that enters by its little gallery satisfies all its wants.

These animals are found in the greatest quantity at Ancona, in Italy. They are found also along the shores of Normandy and Poitou, in France, and upon some of the coasts of Scotland. In general they are considered as a great delicacy at the tables of the luxurious.

Bivalves.

*OF THE MYA TRIBE**.*

The greater part of these animals are inhabitants of the ocean, but some of them are found in fresh water. They perforate the sand or mud at the bottom. Many of the species are caught for food, and others for the pearls which are formed within their shells. Some few of the species perforate and live in limestone, in the same manner as the pholades.

THE PEARL-BEARING MYA†.

The rivers, Tay in Scotland, and Conwy in Wales, are each of them celebrated for producing, in great abundance, the Pearl-bearing Mya. Some of the shells, in each river, contain good pearls, but fine ones are by no means numerous. The greater part have little or no lustre; some are round, oval, or elongated and cylindrical; and others are hemispherical, and somewhat resemble buttons.

The origin of the pearls in these shells has thus been accounted for. The Mya which produces them is attacked by several kinds of enemies. Of these, there is one

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* The shell, in most of the species, is gaping at the end. The hinge is furnished with a strong, thick, and broad tooth, not inserted into the opposite valve. The animal is an *Ascidia*.

† Description. This shell is about two inches long, and five broad, oblong, and somewhat narrower in the middle than at the ends. It is covered over with a dark-coloured, rough epidermis, or skin, except on the protuberant parts near the hinge. There is a single tooth in one of the valves, which locks into a forked one in the other.

Synonym. Mya margaritifera. *Linnæus.*

which penetrates into the inside, near the edge of the valve, by working a longitudinal passage between the different laminæ that compose the cover. This small channel, after extending about an inch and a half in length, doubles back in a line parallel to the first, and separated from it by a thin partition of shelly matter. These two parallel lines discover the direction of the worm in entering and returning; which is also very distinguishable on the surface, by two small holes close to the edge, and in general near the mouth of the shell. As these small channels are excavated in the part nearest the mother-of-pearl, or silvery internal coat, the pearly juice soon extravasates, and protuberances are formed in that direction. The cylindrical bodies thus formed may be considered as elongated pearls, adhering to the internal lining of the shell. When several worms of this kind penetrate near each other, and unite their labours, the result is a sort of pearly wen, with irregular protuberances, in which the issues of the several passages are easily perceptible.

There are other kinds of worms which pierce the pearl shell, and form cavities more or less round, in which the juice consolidates into pearls.

It was doubtless this observation that first suggested to Linnæus, and others, the idea of making artificial perforations in the shells, and thus forcing them to produce pearls. In London, M. Saint Fond saw some shells which had been brought from China, and which had undergone this operation. The artificial hole in these was filled with a piece of brass wire, rivetted on the outside of the shell like the head of a nail; and the part of the wire which pierced the interior shining coat, was covered with a well-shaped pearl, which seemed as if soldered to its extremity. It is probable that with the Chinese this is not a discovery of very modern date.

M. Saint Fond was informed of another mode of obtaining pearls. The shell from which the pearl is to be obtained must be opened with the greatest care, in order to prevent the animal from being injured. A small portion of the inner surface is then to be scraped off, and a spherical piece of mother-of-pearl, about the size of a very small grain of shot, to be introduced. This globule serves as a nucleus to the pearly juice, which concretes around it, and after a certain time produces a fine pearl.

With respect to the pearls of the river Conwy, it is reported that Sir Richard Wynne, of Gwydir, presented one to the queen of Charles the Second, which was afterwards placed in the regal crown. An Irish pearl is mentioned by Sir Robert Redding, in the Philosophical Transactions, which weighed thirty-six carats, and was valued at forty pounds.

OF THE SOLEN OR *RAZOR-SHELL TRIBE**.

The greater part of these animals reside in holes, which they form in the sand at the bottom of the ocean. Their position in these holes is always upright. In situations where they are exposed to the air by the ebbing of the tide, their place is easily known to fishermen, by a small dimple which they leave on the surface. Some of the species embed themselves in stone. Nearly all of them are used as food.

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* The shell is oblong, and open at both ends. Its hinge is furnished with a sharp, reflected tooth, not inserted into any groove in the opposite valve. The animal is an *Ascidia*.

THE COMMON* AND THE SCABBARD RAZOR-SHELL†.

Many of the bivalved shell-fishes have the powers of progressive or retrograde motion, by an instrument that has some resemblance to a leg or foot, and called the *tongue*. But these animals can, at pleasure, make this assume almost every kind of form which their exigencies require.

Like all the other species of Razor-shells, they are incapable of progressive motion on the surface; but they dig a hole or cell in the sand, sometimes two feet in depth, in which they can ascend or descend at pleasure. The instrument, or tongue, by which their motions are performed, is fleshy, cylindrical, and situated near the centre of their body. When necessary, the animals can make the termination of the tongue assume the form of a ball. The Razor-fish, when lying on the surface of the sand, and about to sink into it, extends its tongue from the inferior end of the shell, and makes the extremity of it take the form of a shovel, sharp on each side, and terminating in a point. With this instrument the animal cuts a hole in the sand. After the hole is made, it advances the tongue still further into the sand, makes it assume the form of a hook, and with

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* DESCRIPTION. This shell is seven or eight inches broad, and one inch deep. Is is linear, and straight; and one of the hinges is two-toothed. The colour is olive-brown, with a conoid ash-coloured mark dividing the shells diagonally. One part is striate longitudinally, and the other transversely.

SYNONYMS. Solen Siliqua. *Linnæus*.—Solen Silique. *Bosc.*

† DESCRIPTION. This species is not quite so large as the last. It is linear, straight, roundish and margined at one end. The hinge has a single tooth in each valve. Its general colour is yellowish.

SYNONYMS. Solen vagina. *Linn.*—Le Fourreau. *Cuvier.*—Solen Manche de Couteau. *Bosc.*

this hook, as a fulcrum, it obliges the shell to descend into the hole. In this manner the animal operates until the shell totally disappears. When it chooses to regain the surface, it forms the termination of the tongue into the shape of a ball, and makes an effort to extend the whole tongue: but the ball prevents any further descent, and the muscular effort necessarily pushes the shell upward until it reaches the surface. It is amazing with what dexterity and quickness these seemingly awkward motions are performed.

It is remarkable, that the Razor-fish, though it lives in salt water, abhors salt. When a little salt is thrown into the hole, the animal instantly quits his habitation. But it is still more remarkable, that, if the animal is once seized with the hand, and afterwards allowed to retire into its cell, salt will then be strewed in vain, for the fish will never again make its appearance. If it be not handled, by applying salt, the animal may be made to come to the surface as often as a person pleases; and fishermen often make use of this stratagem.

These shells are not uncommon on most of our sandy shores.

*OF THE CARDIUM OR COCKLE-TRIBE**.

Upon sandy shores of almost all the known seas, some of the species of Cockle are to be observed. Most of them are found immersed in the sand, at the depth of a few inches. Their size is various, from five or six inches to half

* The shell is bivalve, equivalve, convex, and, in most of the species, longitudinally ribbed. The hinge has two teeth near the beak, and a larger one placed remote on each side, locking into the opposite valve. The animal is a *Tethys*.

an inch in diameter. In a fossil state they are by no means uncommon; and species corresponding with some of them inhabit the Indian ocean.

THE COMMON COCKLE*.

All the loco-motive powers of these well-known animals are concentrated in the triangular yellow foot, which is so conspicuous when we open the shells. This foot is not only capable of great inflexion, but also of seizing with its point the glutinous matter which proceeds from it, drawing this into threads, and thereby, in some measure, securing the animals within the sand.

Few of our shell-fish are more common, in inlets and bays near the mouths of rivers, than these. In such situations they are usually found immersed at the depth of two or three inches in the sand, the place of each being marked by a small, circular, depressed spot.

When they open their shells, the entrance into these is protected by a soft membrane, which entirely closes up the front, except in two places, at each of which there is a small, yellow, and fringed tube. By means of these tubes it is that the animals receive and eject the water which conveys to their body the nutriment necessary for their support.

Cockles are in great request as food, and are taken for this purpose chiefly during the winter months. In places where they are not very numerous, they are picked up separately; but where they are sufficiently abundant, they are dug out of the sand, put into ozier baskets, and then soused in the water, for the purpose of clearing them of such sand as hath been dug up along with them.

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* SYNONYMS. Cardium edule. *Linn.*—Bucarde sourdon. *Bosc.*—Le Coque. *Cuvier.*

OF THE OYSTER TRIBE*.

There are few tribes of shell-fish more numerous, or more generally dispersed over the submarine rocks and sands, in all parts of the world, than these. The greater part of them are wholesome and extremely palatable food.

From a similarity in the structure of the hinge, the Oysters and Scallops have been united into one tribe. But they differ very essentially, both in their habits and in their external appearance. The Oysters adhere to rocks, or, as in two or three species, to roots of trees on the shore; while the Scallops are always detached, and usually lurk in the sand.

THE COMMON OYSTER †.

It is the nature of Oysters in general, as Col. Montagu has observed, to have their lower valve fixed to rocks or loose stones, and frequently even to each other. Some of them, however, are loose: these have very thin shells, and are more regularly shaped than the others.

Most of our rocky coasts produce Oysters in great abundance; but those chiefly celebrated for them are the coasts of Essex and Suffolk. Here they are dredged up by means of a net, (with an iron scraper at the mouth,) which is dragged by a rope from a boat, over the beds. As soon as taken from their native beds they are stored in pits formed for the purpose, furnished with sluices; through

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* Oysters are bivalve shell-fish, having the valves generally unequal. The hinge is without teeth, but furnished with a somewhat oval cavity, and mostly with lateral transverse grooves.

† Synonyms. Ostrea edulis. *Linn.*—Huître commune. Bo[illegible]. *Cuvier.*

which, at spring tides, the water is suffered to flow. This water, being stagnant, soon becomes green in warm weather, and in a few days afterwards the Oysters acquire the same tinge, which renders them of greater value in the market: but they do not acquire their full quality, and become fit for sale, till the end of six or eight weeks.

The principal breeding-time of Oysters is in the months of April and May, when they cast their spawn, or *spats*, as the fishermen call them, upon rocks, stones, shells, or any other hard substance that happens to be near the place where they lie, to which the spats immediately adhere. These, till they obtain their film or crust, are somewhat like the drop of a candle, but are of a greenish hue. The substances to which they adhere, of whatever nature, are called *cultch*. From the spawning-time until about the end of July the Oysters are said to be sick, but by the end of August they become perfectly recovered. During these months they are out of season, and are bad eating.

The Oyster fishery of our principal coasts is regulated by a court of admiralty. In the month of May the fishermen are allowed to take the Oysters, in order to separate the spawn from the cultch, the latter of which is thrown in again, for the purpose of preserving the bed for the future. After this month it is felony to carry away the cultch, and otherwise punishable to take any Oyster, between whose shells, when closed, a shilling will rattle. The reason of the heavy penalty on destroying the cultch is, that when this is taken away, the ouse will increase, and muscles and cockles will breed on the bed and destroy the Oysters, by gradually occupying all the places on which the spawn should be cast. There is likewise some penalty for not treading on, and killing, or throwing on shore, any *Star-fish* (Asterias of Linnæus) that happen to be seen.

The prickly Star creeps on with full deceit,
To force the Oyster from his close retreat.
When gaping lids their widen'd void display,
The watchful Star thrusts in a pointed ray,
Of all its treasures spoils the rifled case,
And empty shells the sandy hillocks grace.

Oysters are not reckoned proper for the table until they are about a year and half old; so that the brood of one spring are not to be taken for sale till at least the September twelve months afterward. When younger ones than these happen to be caught in the dredge, they are always thrown into the sea again. The fishermen know the age of Oysters by the broader distances, or interstices, among the rounds or rings of the convex shell.

The Oysters in the pits, of course, always lie loose, but on their native beds they are in general fixed (from the time they are cast) by their under shell; and their goodness is said to be materially affected by their being laid in the pits with the flat shell downward, not being able, in this position, to retain a sufficient quantity of water in the shell for fattening them.

The Oyster has been represented, by many authors, as an animal destitute not only of motion, but of every species of sensation. It is able, however, to perform movements which are perfectly consonant to its wants, to the dangers it apprehends, and to the enemies by which it is attacked. Instead of being destitute of sensation, Oysters are even capable of deriving some knowledge from experience. When removed from situations that are constantly covered with the sea, they open their shells, lose their water, and die in a few days. But, when taken from similar situations, and laid down in places from which the sea occasionally retires, they feel the effect of the sun's rays, or of the cold air, or perhaps apprehend the attacks of

enemies, and accordingly learn to keep their shells close till the tide returns. Oysters breathe by means of gills. They draw the water in at their mouth, a small opening in the upper part of their body, drive it down a long canal that constitutes the base of the gills, and so out again, retaining the air for the necessary functions of the body.

THE GREAT SCALLOP *.

The Scallop has the power of progressive motion upon land, and likewise of swimming on the surface of the water. When this animal happens to be deserted by the tide, it opens its shell to the full extent, then shuts it with a sudden jerk, often rising five or six inches from the ground. In this manner it tumbles forward, until it regains the water. When the sea is calm, troops or little fleets of Scallops, it is said, are sometimes to be observed swimming on the surface. They raise one valve of their shell above the the surface, which becomes a kind of sail, while the other remains on the water, and answers the purpose of a keel, by steadying the animal, and thus preventing its being overset. When an enemy approaches, they instantly close their shells, plunge to the bottom, and the whole fleet disappears. By what means they are enabled to regain the surface, we are totally ignorant.

These animals are frequently sold for the use of the table; and, in some parts, are much esteemed. Col. Montagu was informed, by old and experienced dredgers, that the greatest quantity are always observed to be taken after a fall of snow.

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* SYNONYMS. Ostrea maxima. *Linn.*—Pecten maximus. *Montagu.*—Peigne gigantesque. *Cuvier.*—La Grande Pelerine. *Cuvier.*

*OF THE MUSCLES IN GENERAL**.

Some of the Muscles penetrate into the interior of calcareous rocks, where they reside out of the reach of danger. Others adhere by their beard to the exterior of rocks or stones; and so tenacious is their hold, that, in the larger species, they cannot be separated without considerable exertion. One species is gathered from the depths of the sea, on account of the *pearls* which are found within the shells. Of these, the ancient Romans were extravagantly fond. "It is not enough (says Pliny) to despoil the sea of its riches, in order to gorge our appetites; we must likewise, both men and women, carry them about on our hands, in our ears, upon our heads, and on our whole body."

THE COMMON OR EDIBLE MUSCLE†.

By the silky threads which it forms from its body, this species is found adhering to rocks, both in the European and Indian seas; but it grows to a much larger size between the Tropics, than in the northern climates. It abounds on the British shores, being one of the commonest of our shells.

All the Muscles have, for an instrument of motion, a tongue or foot, capable of considerable elongation, and also of being shortened into the form of a heart. This is marked with a longitudinal furrow, and completely enve-

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* The Muscle tribe is distinguished by the shell being bivalve, without any tooth in the hinge, but in having the hinge marked with a longitudinal hollow line; and by the animal's being generally fixed to some substance by a byssus or silky beard.

† SYNONYMS. Mytilus edulis. *Linn.*—La Moule commune. *Bosc. Cuvier.*

loped in a sheath formed of transverse and circular fibres, of an obscure purple colour. When the animal feels inclined to change its place, it thrusts the foot out of the shell, and raises itself on its edge; then, by reaching this to as great a distance as it will extend, it uses it as kind of arm, drawing the body up to it, and thus it proceeds until it has found a convenient situation. If the Muscle be inclined to make this its residence, the instrument of its motion is now put to a very different employment, in spinning those silky threads which fix it firmly to the spot; and, like a ship at anchor, enable it to brave all the agitations of the water. This it accomplishes by seizing with its point the gluten supplied by a gland situated under its base, and drawing it out, through the furrow, into threads. When the Muscle is thus fixed, it lives upon the little earthy particles, or upon the bodies of such smaller animals as the water transports to its shells.

The present Muscle is generally esteemed a rich and wholesome food; but to some constitutions it often occasions disorders, the symptoms of which are great swellings, eruptions of blotches or pimples, shortness of breath, convulsive motions, and sometimes even delirium. A remedy that has been recommended is two spoons-full of oil, and one of lemon-juice, (or, in want of this, about two of vinegar,) shaken well together, and swallowed as soon as any of the symptoms take place. This unwholesome quality has been attributed to a small species of crab, the *Cancer pisum* of Linnæus, that sometimes is found within the shells. It seems, however, not to have its seat in any thing essential to the Muscle; for, when accidents of this kind have happened, some persons have been affected, and others have not, who have eaten at the same time, and at least in equal quantity.

THE PEARL MUSCLE*.

The Pearl is a calculus or morbid concretion, which is produced not only in these, but sometimes even in the common oysters, muscles, and other shells. It is found both in the body of the animal, and within the shells, on the outside of the body.

The principal fishery for pearls is on the coast of Tinevelly, in Eastern Hindostan, where the natives find them of such commercial importance, as to employ in the fishery several hundreds of small vessels. The pearls are taken at two seasons of the year, in March and April, and again in August and September. They do not, however fish every year; for if, upon trial, they do not find the pearls sufficiently valuable, they abstain until the ensuing season, in order to allow them time to increase their size.

A cord is fastened under the arms of the divers, and held by the persons in the boat; and, to accelerate their descent, the divers have a perforated stone, of eighteen or twenty pounds weight, tied by a cord to their great toe. Each of them is also furnished with a sack, that has the mouth distended by a hoop. They then descend, and, on reaching the bottom, slip off the stone, which is drawn up, and fill their sack with shells. When this is full, they give a signal, by pulling the rope, and they are then themselves drawn up by the men in the boats.

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* Description. The Pearl Muscle has a flattened and nearly orbicular shell, about eight inches long, and somewhat more in breadth. The colour of the exterior is very various, being in some individuals sea-green, in others chesnut, or even bloom colour, with white rays, and sometimes whitish, with green rays. The young shells resemble scallops, having ears as long as the shell.

Synonyms. Mytilus Margaritiferens. *Linn.*—La Moule Perle. *Bosc.*—La Moule du Rhin. Unio Margaritifera. *Cuvier.*

The depth of the water is twenty or thirty yards, and the distance from shore four or five leagues. When drawn up, they rest eight or ten minutes, to recover their breath, and then plunge in again; and a succession of men continue this slavish employment for ten or twelve hours every day. The shells are left in vast heaps to putrefy until the season is over. The gains of the adventurers are often small, as the success is very precarious. Great pearls are but seldom found, and the generality of what are taken, are of the smaller kind, called Seed Pearls, which are sold by the ounce, to be converted into powder.

The *shells* are found adhering to the coral banks. Numbers of sharks lurk about the diving-places, and often devour the poor adventurers.

*OF THE PINNA TRIBE**.

Few tribes of shell-fish have been more celebrated, even from the remotest periods of antiquity, than these. They are usually found in the sand or mud, in an erect position, with their larger end a little open. In this position they are firmly fixed, by means of a fine and strong byssus or silk, the fibres of which are agglutinated to the gravel, sand, roots of marine plants, broken shells, and other extraneous substances.

The animals of many of the species are used as food, and are in great request for the table.

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* This shell is a bivalve, fragile, upright, gaping at one end, and furnished with a silky byssus or beard. The hinge has no tooth; and the valves are connected on one side through nearly their whole length.—The animal is an *Ascidia?*

THE SEA-WING*.

A bed of these shells was discovered, a few years ago, in Salcomb Bay, near Kingsbridge, Devonshire, by Col. Montagu, who has given us a very interesting account of them. He states, that they inhabit a gravelly bottom, covered with mud and long sea-weeds, and are only to be approached at particular times, when the sea recedes further than usual.

They stand upright, with the broad end about an inch above the surface, the lower end fixed by a large and strong byssus, which is so firmly attached to the gravel, that it requires some force to draw them up; and, even when dragged out, the byssus is most commonly left behind. This beard is composed of numerous fine, silk-like fibres, of a dark purplish brown colour, and two or three inches in length.

Many of these shells are taken annually, the animals being accounted a very palatable food; but they require at least five or six hours stewing, in order to render them eatable; if this is properly attended to, they are nearly as good as Scallops, but never so tender.

The bank, near Kingsbridge, on which these shells are found, probably increases, so that the water leaves a greater portion of it exposed at every spring tide, than

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* Description. These shells are of all sizes, from an inch to a foot in length. They are very rugged, with irregular, concentric wrinkles, running lengthways from the beak, at the open side, and turning to the hinge, nearly at right angles; sometimes breaking into laminæ or plates. The large old shells, are of an opaque horn colour: the small ones are paler, and more diaphanous: all, more or less, of a changeable green colour at the bottom of the shell. The valves are connected through the whole length. *Montagu.*

Synonym. Pinna ingens. *Pennant. Montagu.*

formerly; and, in consequence, they become an easy prey to crows and gulls. Consequently, few are now to be obtained here, except at unusually low tides.

According to Aristotle, the byssus of the ancients was the beard of one of the species of Pinna; but the name seems to have been used indiscriminately by other writers, for any spun material that was esteemed finer or more valuable than wool. Reaumur says, the threads of the byssus are not less fine or less beautiful than silk, as it is spun by the silk-worm. The Pinna on the coasts of Italy and Provence, (where it is fished up by means of iron-hooks fixed on long poles,) is called the silk-worm of the sea. The stockings and gloves manufactured from it, are of exquisite fineness, but too warm for common wear.

The Pinna, observes Col. Montagu, has long been celebrated for giving protection to a small species of crab, which was supposed to be of use to it, by giving it notice either of approaching danger, or of the presence of its prey. Respecting this circumstance, many stories have been handed down to us from the earliest times. These, although not wholly unfounded, are mixed with too much fable to be fully credited in this enlightened age.

Univalves.

OF THE ARGONAUTS IN GENERAL.

The animals of the Argonaut tribe, have a near alliance to the Sepiæ or Cuttle-fishes. The shells are spiral, involute, of a white substance, and so thin, as almost to resemble paper. They have each only a single cell, and are not to be confounded with the Chambered or Pearly Nautili, which belong to a different class, and bear very

little resemblance to those of the present, either in their structure or habits.

THE PAPER NAUTILUS, OR ARGONAUT*.

This was the famous *Nautilus* of the ancients, and is supposed, in the early ages of society, to have furnished the original idea of navigation:

> Learn of the little Nautilus to sail,
> Spread the thin oar, and catch the driving gale.

When it means to sail, this animal discharges a quantity of water from its shell, by which means it is rendered lighter than the surrounding medium, and of course rises to the surface. Here it extends two of its arms upward. These are each furnished at their extremity with an oval membrane, which serves as a sail. The other six arms hang over the sides of the shell, and supply the place of oars and rudder.

> Two feet they upward raise, and steady keep;
> These are the masts and rigging of the ship.
> A membrane stretch'd between supplies the sail,
> Bends from the masts, and swells before the gale.
> The other feet hang paddling on each side,
> And serve for oars to row, and helm to guide.
> 'Tis thus they sail, pleas'd with the wanton game,
> The fish, the sailor, and the ship the same.
> But, when the swimmers dread some danger near,
> The sportive pleasure yields to stronger fear:

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* Description. This shell is six or eight inches in length, of a white or yellowish colour, and but little thicker than paper. It is compressed at the sides, and has a double row of tubercles. The keel or ridge of the shell is slightly toothed on each side.

Synonyms. Argonauta Argo. *Linn.*—Argonauta Papyracé. *Bosc.*

No more they wanton drive before the blasts,
But strike the sails, and bring down all the masts.
The roiling waves their sinking shells o'erflow,
And dash them down again to sands below.

In some places, when the sea is not agitated by winds, great numbers of these singular creatures may occasionally be seen diverting themselves by sailing about in this manner; but as soon as a storm arises, or any thing gives them disturbance, they retract their arms, take in as much water as renders them heavier than that in which they swim, and sink to the bottom. Several of them were observed by M. Le Vaillant, on the sea near the Cape of Good Hope; and, as he was desirous of obtaining perfect specimens of the shells, he sent some of his people into the water to catch them: but, when the men had got their hands within a certain distance, they always instantly sank, and, with all the art that could be employed, they were not able to lay hold of a single one. The instinct of the animal showed itself superior to all their subtlety; and, when their disappointed master called them away from their attempts, they expressed themselves not a little chagrined at being outwitted by a shell-fish.

These animals are found in the Mediterranean, the Indian Ocean, and in the neighbourhood of the Cape of Good Hope.

OF THE CYPRÆAS, OR COWRIES *.

There is no tribe of shells which, on the whole, are more beautiful than these. From their high polish and brilliant

* These shells are univalve, involuted, of a somewhat ovate shape, obtuse, and smooth. The aperture is linear, extended through the whole length of the shell, and dentated on both sides.—The animal is a *Limax*, or Slug.

colours, they have derived the name by which they are most commonly known in France, of *Porcelaines.* The species are very numerous. In uncivilized countries several of them are used as ornaments for the person, both of men and women, and some are worn as amulets or charms against disease.

They reside in the sand at the bottom of the sea, and are furnished with a membrane, which is so extensive, that they are able to throw it over their whole shells, and thus preserve them always pure and polished. These animals have two horns; and the canal by which they respire, is situated on the top of their head.

THE TIGER* AND MONEY COWRY†.

There are few shells of the present tribe more common in collections, and at the same time more beautiful, than the former of these species. It is found both in the Indian and Adriatic Seas. The latter are well known on almost all the coasts of Africa and India, where they are employed by the natives in commerce, instead of money, about two thousand of them being esteemed equal in value to a rupee. The negro women, it is stated, fish for them usually three days before or after the full moon; and

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* Description. The Tiger Cowry is usually about four inches and a half long; of an ovate shape, obtuse behind, and rounded before. It is highly polished, of a ferruginous colour, with dark brown spots, and a yellowish longitudinal line along the back. It has sometimes a yellowish or bluish gloss. The under part is white.

Synonyms. Cypræa Tigris. *Linnæus.*—Porcelaine Tigre. *Bosc.*—Le Tigre. *Cuvier.*

† Description. This species is about three quarters of an inch in length. It is of a whitish colour, and has a knotted margin.

Synonyms. Cypræa Moneta. *Linnæus.*—Porcelaine Monnoie. *Bosc.*—Le Cauris. *Cuvier.*

thirty or forty vessels are annually laden with them in the Maldivian Islands, for exportation to Africa, Bengal, Siam, and the adjacent islands, for the purposes of commerce.

Of the Cowries, a very remarkable fact has been stated by M. Bruguière, that when the animals find their shells too small for the increased dimension of their body, they quit them, and proceed to the formation of new ones of larger size, and consequently better adapted to their wants.

As soon as the Cowry has abandoned its covering, the hinder parts of its body begin to furnish anew the testaceous matter, which is afterwards condensed upon its surface. This secretion is continued, until at length the shell appears of the consistence of paper: and the mouth or opening of the shell, which at this period is very wide, soon afterwards contracts to its proper form and dimension. The edges are thickened, and form into those beautiful folds or teeth, which are so remarkable on each side of the opening of these shells; and by means of the membranaceous wings of the animals, the highly polished surface of the whole exterior of the shells is by degrees completed.

OF THE BUCCINUM, OR WHELK TRIBE.*

The situations in which the animals of the present tribe are chiefly found, are submarine rocks, stones, and weeds. To these they adhere so firmly, as not easily to be loosened, either by the waves or the currents of the ocean. A few of them are of large size. Their shells are peculiarly thick and strong; and some of the larger kinds were anciently employed as trumpets, by the sound of which the soldier was summoned to arms.

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* The shell is univalve, spiral, and gibbous. The aperture is ovate, and ends in a short canal or gutter, which bends to the right. —The animal is a *Limax*, or Slug.

THE PURPLE-STAINING WHELK *.

In ancient times, these animals, or some others of the present tribe, were very celebrated on the coasts of the Mediterranean, on account of a valuable purple dye which was extracted from them. They have, however, of late years, been entirely neglected, in consequence of the discovery of cochineal, from which a dye equally excellent, and at much less cost, is to be procured. The number of these shells necessary to have been collected together for the purpose of dying even a small quantity of cloth, must have been very great. The dying matter, like the ink in the Cuttle-fish, is found in a peculiar reservoir, situated in the upper part of the body, and on one side of the stomach. This reservoir is very small, being seldom so large as a small pea.

The natives of South America, who employ the juice of these animals in dying, extract it in two ways. They sometimes break the shell, and, taking out the animal, lay it on the back of one of their hands: with a knife press the juice from the head towards the tail, then separating the part of the body into which it is collected, throw the rest away. The usual mode, however, is not to break the shell, but only to squeeze the animal until it throws up the juice: they then return it to the rocks, where it soon recovers from its bruises.

When the juice is first extracted, it is of a greenish

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* Description. The length of this shell is generally from an inch to an inch and half. It is of an ovate shape, acute, and spirally striated, without protuberances: the pillar is flattish. It varies in colour, being white, cinereous, or yellowish, and sometimes being transversely barred.

Synonyms. Buccinum lapillus. *Linn.*—Buccin teinturier. *Bosc.*

colour, and viscous consistency, and in smell not altogether unlike that of garlick or asafœtida. It does not assume its purple tint, until it has been some time exposed to the action of the sun and air. This dye is so indelible, as to bid defiance to any known chemical process to extract it. In a handkerchief which I stained with it, the colour was retained with undiminished brilliancy for several years.

These animals adhere to rocks and stones, and feed on the smaller kinds of marine worms, which they suck by means of a tubular proboscis, situated beneath the head. They are able to close the aperture of their shells, and thus secure themselves from the attack of all the smaller animals of the deep, by means of a thin cartilaginous or horny cover or *operculum*, which is attached to their body, and is exactly the size of the opening.

OF THE HELICES, OR SNAILS IN GENERAL.

The All-wise Author of Nature has denied to these animals the use of feet and claws, to enable them to move from place to place, but he has made them ample amends in a way more commodious to their habits and mode of life, by the broad skin along each side of the belly, and the power of motion which this possesses. By this motion they are enabled to creep, and by the skin, assisted with the glutinous slime emitted from their body, they adhere firmly and securely even to the smoothest surfaces.

When the snail is in motion, four horns are distinctly seen on its head; but the two uppermost and longest of these deserve peculiar consideration, both on account of the various motions with which they are endued, and also from their having eyes at the extreme ends of them. These eyes appear like two blackish points, and, when taken from the body, are of a bulbous figure. They have

but one coat; and the vitreous, the aqueous, and the crystalline humours, are (though not very distinctly) to be seen. The animal is able to direct them towards different objects at pleasure, by a regular motion out of the body; and sometimes it hides them, by a very swift contraction into the belly. Under the smaller horns, is the animal's mouth; and though its substance may appear too soft to be furnished with teeth, yet it has no fewer than eight. With these it chews leaves and other substances, seemingly harder than any part of its own body; and with these it even sometimes bites off pieces of its own shell.

From various experiments that have been made on snails, it appears that they are possessed of considerable powers of reproduction. Spallanzani found that the whole head might be cut off, and that in a certain time, another would be formed.

THE GARDEN SNAIL *, HEDGE SNAIL †, AND GROVE SNAIL ‡.

See to the fight the gentle warriors move,
And dart, with harmless force, the shafts of love!

The mode of breeding, in this and a few other species of snails, is extremely curious. At a certain time of the

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* Description. The Garden Snail is generally of a yellowish colour, with four tawny bands, interrupted by white spots. The lip is white. The whorls are rounded; and the shell is imperforate.

Synonyms. Helix hortensis. *Linn.*—Hélice des Jardins. *Bosc.*

† Description. This species is of a nearly globular shape, somewhat pellucid, and banded with various colours. The aperture is broader than it is long. The whorls are rounded; and, as in the last, the shell is imperforate.

Synonyms. Helix nemoralis. *Linn.*—La Livrée. *Cuvier. Bosc.*

‡ Description. The Grove Snail is mottled with gray, brown,

year they meet in pairs, and stationing themselves an inch or two apart, launch several little darts, not quite half an inch long, at each other.—These are of a horny substance, and sharply pointed at one end. The animals, during the breeding season, are provided with a little reservoir for them, situated in the neck, and opening on the right side. On the discharge of the first dart, the wounded snail immediately retaliates on its aggressor, by ejecting at it a similar one: the other renews the battle, and in turn is again wounded. Thus are the darts of Cupid, metaphorical with all the rest of the creation, here completely realized in snails. After the combat, they come together. Each of them lays its eggs in some sheltered and moist situation, generally under a little clod of earth, or in some cool cavity. The eggs are about the size of small peas, semi-transparent, and of a soft substance. From these the young are hatched completely formed, with shells on their backs; and they undergo no further change than what necessarily takes place in the gradual increase of their size.

The depredations which these animals commit in gardens and orchards, are very considerable; and it is remarkable, that in defect of moist and succulent food, such as fruit and tender leaves, they will even attack substances of a dry and hard nature. The Common Garden Snail has been known, when confined for a single night, under a glass of more than four inches in diameter, placed on a sheet of common blue paper, entirely to devour the whole paper contained within the included space, to the very edge

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yellowish, and chesnut. It is convex and pointed. The aperture is nearly circular, with a reflected margin, elongated on the fore part. The whorls are rounded, and the shell is slightly umbilicate.

SYNONYMS. Helix arbustorum. *Linnæus.*—Hélice des Arbustes. *Tigny.*

of the glass, so that a circular piece seemed almost as neatly taken out, as if it had been marked by a pair of compasses.

The Snail, if its shell is broken, has a power of mending it. Even when apparently crushed to pieces, these animals will set to work; and with the slimy substance they force from their bodies, which soon hardens, they in a few days close up all the numerous chasms. The junctures, however, are easily distinguishable; and the whole shell, in some measure, resembles an old coat patched with new pieces. But, although the animal has the power of repairing its shell, it is not able to form a new one.—Swammerdam tried the experiment. He stripped a snail of its shell, without injuring any of the blood-vessels; but it died in three days after it had lost its covering: not, however, without having made efforts to restore it, for, before its death, it pressed out a certain membrane round the whole surface of its body. This membrane was entirely of the shelly nature, and was intended, no doubt, as a supply toward a new one.

The following instances of tenacity of life in snails, are well authenticated, and probably without parallel in any other division of the animal creation.

Mr. Stuckey Simon, a merchant of Dublin, whose father, a fellow of the Royal Society, and a lover of natural history, left to him a small collection of fossils and other curiosities, had among them the shells of some snails. About *fifteen years* after his father's death, (in whose possession they had continued many years,) he gave to his son, a child about ten years old, some of these snail-shells to play with. The boy put them into a flower-pot, which he filled with water, and the next day into a bason. Having occasion to use this, Mr. Simon observed that the animals had come out of their shells. He examined the child, who assured him that they were the same he had

given him, and said he had also a few more, which he brought. Mr. S. put one of these into water, and in an hour and a half after, observed that it had put out its horns and body, which it moved but slowly, probably from weakness. Major Vallancy, Dr. Span, and other gentlemen, were afterwards present, and saw one of the snails crawl out, the remainder being dead, most probably from their having remained some days in the water.

This shell was sent to Sir John Pringle, who showed it at a meeting of the Royal Society; but some of the members imagining that Mr. Simon must have been imposed upon, by his son having substituted fresh shells for those that had been given to him, the boy was examined by Dr. Macbride on the subject, who declared that he could find no reason to believe that the child either did or could impose upon his father. Mr. Simon's living in the heart of the city, rendered it almost impossible for the boy (if he had been so disposed) to collect fresh shells, being at that time confined to the house with a cold. Mr. Simon declared, that he was positive those were the shells he gave to him, having in his cabinet many more of the same sort, and nearly of the same size.

After this account had been made public, there appeared in the Annual Register the following very singular narration. It was sent to the editors by a Mr. Rowe, who states it to have been written by a lady, whose name he was not at liberty to mention.

"I was at Mr. Haddock's, at Wrotham, in Kent, and was making a little shell-work tower, to stand on a cabinet in a long gallery. After having repaired two small amber temples to grace the corners, I was desirous of having some ornament for the front; and sea-shells running short before I had finished, I recollected having seen some pretty little snails on the chalk hills there; and we all went one evening to pick up some. On our return I

procured a large china basin, and putting a handful or two of them into it, filled it up with boiling water. I poured off the first water, and filled the bowl again. I then carried it into a summer-house in the garden, where I loved to work early in a morning, before my friends were stirring. Next morning, how great was my surprise, on entering the summer-house, to find my poor snails crawling about, some on the edge of the basin, some tumbling over, some on the table, and one or two actually eating the paste that was to stick them on! I was perfectly shocked, and burst into tears; and picking up every snail carefully, carried them into a field beyond the garden, where I make no doubt but they perfectly recovered their scalding."

THE ESCULENT SNAIL *.

This is the largest of all the land snails produced in this country. It is found in the woods and under hedges in Northamptonshire, and some others of the southern counties.

At the commencement of winter, it carefully closes up its shell with a thick white cover or operculum, attached to its body, that just fills up the opening, and in this enclosed state, remains until the commencement of warm weather, seldom appearing abroad till about the beginning of April.

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* Description. This species is sometimes more than two inches in diameter. It is of a nearly globular shape; and of a brownish white colour, with usually three reddish bands round the larger whorl. The aperture is large, somewhat lunate, and with the margin thickened and reflected. The pillar-lip is reflected. The whorls are rounded; and it is umbilicate.

Synonyms. Helix pomatia. *Linn.*—Hélice des Vignes ou Escargot. *Bosc.*—Le Grand Colimaçon des Vignes. *Cuvier.*

It is large and fleshy, and, when properly cooked, not unpleasant to the taste. Among the Romans it constituted a favourite dish; but, if the account of Varro is to be credited, they had it of a size infinitely larger than any now known; for this writer assures us, that the shells of some of them would hold ten quarts. They kept these animals in what were called *Cochlearia*, or Snail Stews. These were generally formed under rocks or eminences, whose bottoms were watered by lakes or rivers; and, if a natural dew or moisture was not found, they formed an artificial one, by bringing into the place a pipe bored full of holes, like a watering-pot, through which it was continually sprinkled. They required little attendance or food, supplying themselves, in a great measure, as they crawled about the sides or floor of their habitation. To fatten them, however, they were fed with bran and sodden lees of wine.

They are even yet much admired in some parts of the Continent, and are not always used from economical motives; for at Vienna, but a few years ago, seven of them were charged the same at an inn, as a plate of veal or beef. The usual modes of preparing them for the table, are by boiling, frying them in butter, or sometimes stuffing them with force meat: but, in what manner soever they are dressed, their sliminess always in a great measure remains. The greatest quantities, and the finest snails, are brought from Suabia. Dr. Browne, who travelled to Vienna above a century ago, remarks, that since the markets were so well supplied with other provisions, "he was surprised to meet with some odd dishes at their tables, such as guinea-pigs, and divers sorts of snails and tortoises."

Dr. Townson was shown at Erlau, a snailery, which, the proprietor informed him, was constructed on an improved plan. In our island, he says, this might have had the denomination of a *Patent Snailery*, or *Philosophical*

Snail-sty. It consisted only of a large hole, two or three feet deep, dug in the ground, having a wooden house as a cover. The animals in this place were fed on the refuse of the garden, which was thrown into them.

There seems some doubt as to the original introduction of these snails into England: Pennant says, it was by Sir Kenelm Digby; and Da Costa, that a Charles Howard, Esq. of the Arundel family, brought some of them, in the last century, from Italy, in the hope of rendering them an article of food in England; and, for this purpose, dispersed them about the woods and downs of Albury, an ancient seat of that family, near Boxhill in Surry. They are now to be found in considerable plenty, not only there, but also in several parts of the confines of Sussex.

Zoophytes *.

OF THE MADREPORES IN GENERAL†.

The great variety of Madrepores, their conspicuous appearance in the water, and their astonishing quantity on some coasts, have caused them to be remarked by navigators and travellers, from the earliest periods. They are all composed of calcareous matter, united with a portion of animal substance. By calcination they yield an excellent lime.

In certain species, their substance is extremely hard and solid; and in others, cellular and friable. Their form also varies much. Some are spherical, others semi-globose,

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* The creatures that are ranked under the Linnean order *Zoophyta* seem to hold a middle station between animals and vegetables. Most of them, deprived altogether of the powers of loco-motion, are fixed by stems that take root in crevices of rocks, among sand, or in such other situations as nature has destined for their abode: these, by degrees, send off branches, till at length some of them attain the size and extent of large shrubs. The Zoophytes are usually considered under two divisions. The stony branches of the first division, which has the general appellation of *Coral*, are hollow, and full of cells, which are the habitations of animals resembling Polypes, Medusæ, &c. according to their respective genera. The next division consists of such animals as have softer stems, and are, in general, not merely inhabitants of a stem or branches, but are themselves in the form of a plant. Those of this division which are best known are the Corallines, the Sponges, and the Polypes.

† The animals which inhabit the Madrepores are Medusæ. The coral which contains them is fixed and simple, or branched, with cavities composed of lamellæ in a star-like form.

and others flat: many are branched; and the branches of some are smooth, and of others hairy, furrowed, or striated. With respect to colour, they are red, yellow, brown, &c. but their most prevalent colour is yellowish white.

It is principally in hot climates, betwixt the Tropics, that they are in greatest abundance. Few of them have been observed in any of the European seas, except the Mediterranean. Many species are found in a fossil state.

THE BRANCHING * AND PRICKLY MADREPORE †.

At the extremity of each branch of the former of these species there is a star, composed of about seventeen rays or laminæ, which issue from the centre. The animals which inhabit these stars have their head in the centre, and are furnished with about eight feathery tentacula, by means of which they are enabled to seize their prey. When undisturbed, they protrude themselves from their cases, and oscillate from right to left, and from left to right, for a considerable while together, with an extremely quick motion. On any alarm, they immediately withdraw, and nothing is seen but the naked stem and branches.

In all their parts these little creatures are very tender and delicate. Their bodies are nearly transparent, and

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* DESCRIPTION. This species, which grows to the height of two feet and upwards, is branched, and has distinct stars. The branches are striated, nearly pinnate, cylindrical, and truncate: the stars are at the extremities.

SYNONYMS. Madrepora ramea. *Linnæus.*—Madrépore ramé. *Tigny.*—Le Porite branchu. *Cuvier.*

† DESCRIPTION. The Prickly Madrepore, like the last species, is branched, and has distinct stars. It is composite, and subimbricate, with obliquely truncate, prominent, and ascending stars.

SYNONYMS. Madrepora muricata. *Linn.*—Madrépore Murique. *Bosc.*

marked with beautiful colours. This species is found in the Indian, the Mediterranean, and Atlantic seas; and, in its whole stem and branches, is sometimes twenty inches or two feet high.

The *Prickly Madrepore*, in some of the southern climates, is in such extraordinary abundance as occasionally to form immense beds at the bottom of the sea. In height it increases, without limit, until arrested by the line of low water; and in width it is boundless. Captain Cook, and other navigators, have spoken of banks or reefs of coral, or Madrepore, so extensive as to have prevented their approach to land, sometimes even for several leagues. Many voyagers have mentioned the dangers to which they have been exposed, during stormy weather, upon these reefs, not only from their liability to be wrecked, by the ships driving against such as rose nearly to the surface of the water, but also from the cables to which their anchors were fixed having been cut in pieces by chafing against them.

There can be no doubt but that several kinds of Madrepore concur in the formation of these reefs; but that which, in general, constitutes by far the greatest portion, is the species here mentioned.

OF THE CORAL TRIBE.

All the different species of Coral are branched, and the branches are not articulated. Their interior is stony and solid. The surface is striated, and covered by a bark-like envelope, which is fleshy and porous; and from which there issue numerous animals, resembling polypes both in appearance and structure.

THE RED CORAL*.

Few persons are unacquainted with this production, at least in a wrought state, as forming necklaces or bracelets for the ornament of the female figure. It is, perhaps, the most valuable of all the productions of the sea, except pearls; and constitutes a very important article of commerce.

Its general appearance is that of a shrub deprived of leaves, the stem being sometimes from three to six inches in diameter, and its whole height being usually from three to four feet. The interior both of the stem and branches is equal to marble in hardness. The polypes which issue from the branches are white, soft, and semi-transparent. Their tentacula are eight in number, equal in length, and fortified with several conical appendages. The mouth is situated in the centre of the tentacula; and below this is the stomach, which is short. The animals are no further connected to the parietes of their cells, than by a very slender ligament.

When Coral is taken up from the water, or even touched whilst under water, all the polypes suddenly contract. In this operation the appendices of the tentacula close within themselves, like the horns of snails; afterwards each tentaculum is folded towards the middle, the mouths then close, and the animals are completely concealed.

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* Description. The branches are stony, red, cylindrical, tapering, and expanded. The flesh is red, soft, slimy, and full of minute pores. The pores or florets on the branches are irregularly situated, somewhat prominent, and consist of eight valves, from which the polypes proceed.

Synonyms. Corallium nobilis. *Cuvier.*—Gorgonia nobilis. *Linn. Gmel.*—Isis nobilis. *Linn. Syst. Nat.*—Corail rouge. *Bosc.*

Donati observed, near the bottom of these polypes, several small, yellowish bodies, which proved to be the offspring or eggs. These, as soon as they were detached, fixed themselves firmly to those bodies on which they happened to fall. Here they extended their base, and, when the fœtus was perfected, it opened, and a polype issued from the orifice. This has a small horn at its base: after a while, another springs from the side; then a third; and, lastly, a tree of Coral ascends.

The fishing for Coral is, at this day, an object of great importance to the inhabitants of Marseilles, Catalonia, and Corsica; and the principal parts of the Mediterranean from which it is obtained, are the coasts of Tunis and Sardinia, and the mouth of the Adriatic. The fishers employ, for this purpose, a very simple kind of machine, consisting of two strong bars of iron or wood tied across each other. From the centre of the union of these they hang a weight. Each of the arms is loosely surrounded through its whole length with twisted hemp; and at the extremity there is a small open purse or net. To use this machine, it is suspended by a rope, and dragged along those rocks where the Coral is most abundant. A considerable part of the Coral which is broken off, either becomes entangled in the hemp, or falls into the nets. This operation is usually carried on in places where the water is from eight to ten fathoms in depth.

The most valuable Coral, however, as being the largest in size, and most compact in substance, is that which is brought from the East.

OF THE SPONGES IN GENERAL.

The Sponges consist of an entirely ramified mass of capillary tubes, supposed, by many, to be the production of a species of worms which are often found straying about

the cavities. This idea is now, however, nearly exploded. Others have imagined them mere vegetables. But that they are possessed of a living principle seems evident, from the circumstance of their alternately contracting and dilating their pores; and shrinking, in some degree, from the touch, whenever examined in their native waters. They are capable of absorbing nutriment from the fluid in which they are, by nature, immersed. The species differ very greatly from each other, both in shape and structure. Some are composod of reticulated fibres, or masses, of small spines: some, as the Common or Officinal Sponge, are of no regular shape; others are cup-shaped, and others tubular.

THE OFFICINAL* AND DOWNY SPONGE†.

The Officinal Sponge is well known, from the circumstance of its utility for various domestic purposes.— It is an elastic substance, and in every part is full of holes. It grows into irregular lobes of a woolly consistence, and generally adheres, by a broad base, to the rocks. A variety of small marine animals pierce and gnaw into its irregular, winding cavities. These appear on the outside, by large holes, raised higher than the rest. When it is cut perpendicularly, the interior parts are seen to consist of small tubes, which divide into branches as they

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* Description. This well-known species is of irregular form, porous, tough, lobed, and woolly.

Synonyms. Spongia officinalis. *Linn.*—Eponge commune. *Bosc.* L'Eponge des boutiques. *Cuvier.*

† Description. The tomentous Sponge is porous, of irregular form, brittle, soft, downy, and interwoven with extremely minute spines. When fresh it is of a bright orange-colour, and full of gelatinous flesh: when dry it is whitish, and very light.

Synonyms. Spongia tomentosa. *Linn.*—Eponge velue. *Bosc.*

appear on the surface. These tubes, which are composed of reticulated fibres, extend themselves every way, by this means increasing the surface of the Sponge, and ending at the outside in an infinite number of small, circular holes, which are the proper mouths of the animal. Each of these holes is surrounded by a few erect, pointed fibres, that appear as if woven in the form of little spines. The tubes, with their ramifications, in the living state of the Sponge, are clothed with a gelatinous substance, properly called the flesh of the animal.

Sponge is an object of commerce in the Mediterranean, and in several of the islands of the Grecian Archipelago, on the submarine rocks in the neighbourhood of which it is found, of large size and in great abundance. As it is chiefly found on rocks, at the depth of five or six fathoms, it has been the cause of many of the inhabitants of these islands having become excellent divers. Yet this fatiguing and dangerous employment does not at all enrich them; for Olivier reports, that they are in a state of the most lamentable poverty and wretchedness.

When first taken out of the sea, Sponges have a strong fishy smell, which the fishermen get rid of by washing them perfectly clean in fresh water. This is all the preparation which is necessary previously to their being packed together for sale; but, without it, they would soon become putrid, and perish.

The reproduction of Sponge is more rapid than would, perhaps, be imagined: it is to be found, in perfection, in places from which, only two years before, it has been entirely cleared.

The Downy Sponge is a species very common on nearly all the coasts of Great Britain. It grows round the stalks of several kinds of fuci; and is full of papillæ, or small protuberances, in each of which there is a hole, through

which it sucks in and squirts out the sea-water, thus giving evident signs of life and motion. When viewed in the microscope, its surface appears composed of an infinite number of minute spiculæ, or prickles, which, if rubbed on the skin, will raise blisters like *cow-itch*. And it is stated, that this property is much increased if it be dried in an oven.

OF THE SERTULARIÆ, OR VESICULAR CORALLINES.

The general appearance of all the species of Vesicular Corallines, is exceedingly delicate and beautiful. They have the form of plants, being fixed by a base to submarine rocks, to shells, sea-weeds, or other solid bodies, and usually branching upward in a peculiarly elegant manner. Their stems are composed of a horny or elastic and semi-transparent substance, which does not effervesce with acids. These stems are tubulous, and beset throughout with numerous cup-shaped denticles, from which there issue little heads, in the form of polypes. In some of the species the polypes are on one side only of the branches; in others, on both sides; and in others they are verticillate. The colour varies; but the greater part of them are either white, or of a transparent brown; and nearly all of them become brownish when dried.

The Vesicular Corallines form a very numerous tribe. They are common on all the coasts of Europe. By the ancient naturalists, they were considered to be vegetable productions; and they were first transferred to their proper place, in the animal kingdom, by that indefatigable naturalist, the late Mr. Ellis.

Some of the species are oviparous, and others produce living offspring.

THE SEA OAK SERTULARIA*.

Like all other polypes, the animals which inhabit the Sea Oak Sertularia subsist on marine animalcules, which they arrest, and conduct to their mouth, by means of their tentacula. This Sertularia is found on various species of fuci, or sea-weeds, but chiefly on that which is denominated by Linnæus *fucus serratus*.

On any alarm, the polypes immediately draw up and conceal themselves within their horny cells. They are sometimes luminous in the dark; for, if the leaf of the plant to which they adhere receive a smart stroke with a stick, the whole Sertularia will be most beautifully illuminated, every point from which a polype issues appearing as if on fire.

The ovaries of these animals are small, ovate bladders, which adhere to the branches. When the young ones are discharged from the ovaries, they adhere, by their base, to the first object adapted to their wants on which they happen to fall. In this situation they quickly procure, with their tentacula, sufficient nourishment to increase their bulk. The stem soon begins to advance; and many more heads, with their tentacula, issue forth and stretch themselves out, for the purpose of obtaining food. This causes, observes Mr. Ellis, a further increase of nourishment to be drawn in, which circulates through the whole animal, and enables it to send forth from its base creeping and adhering tubes, full of the same medullary substance with the rest of its body. These tubes not only secure it from the motion

* Description. In this species the denticles bearing the polypes are opposite, pointed, and bend backward. The ovaries are obovate; and the branches irregular.

Synonyms. Sertularia pumila. *Linn.*—Sertulaire naine. *Bosc.*

of the waves, but likewise there arise from them other young animals, or Sertulariæ, which, growing up like the former, with their proper heads or organs to procure food, send out adhering tubes from below; so that, in a short time, a whole grove of Sertulariæ is thus formed.

OF THE HYDRA OR POLYPE TRIBE.

Polypes are gelatinous animals, consisting of a long tubular body, fixed at the base, and surrounded at the mouth by arms or tentacula. They are chiefly inhabitants of fresh-waters, and are among the most wonderful productions of nature. The particulars of their life, their mode of propagation, and powers of reproduction, after being cut to pieces, are truly astonishing to a reflecting mind. Long after experiments had been made did scepticism involve the philosophic world; and the history of the animals did not obtain complete credit till these had not only been often repeated, but had been varied in every possible manner.

THE LONG-ARMED * AND GREEN POLYPE †.

These are two species which will fully illustrate the nature of the whole tribe. They are found in clear waters,

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* Description. The Common or Long-armed Polype is about an inch in length, of a yellowish-gray colour. It has usually around the mouth about seven tentacula, which are longer than the body. The general shape of the body is somewhat cylindrical, tapering towards the base.

Synonyms. Hydra grisea. *Linn.*—Hydre grise. *Bosc.*—L'Hydre à longs bras, in France.

† Description. This species is of a green colour, and furnished usually with eight tentacula, which are shorter than the body. Like

and may generally be seen, in great plenty, in small ditches and trenches of fields, especially in the months of April and May. They affix themselves to the under parts of leaves, and to the stalks of such vegetables as happen to grow immersed in the same water; feeding on the various species of small worms, and other aquatic animals that happen to approach. When any animal of this kind passes near a Polype, it suddenly catches it with its arms, and, dragging it to its mouth, swallows it by degrees, much in the same manner as a snake swallows a frog. Two of them may occasionally be seen in the act of seizing the same worm at different ends, and dragging it, in opposite directions, with great force. It sometimes happens, that, while one is swallowing its respective end, the other is also employed in the same manner; and thus they continue swallowing each his part, until their mouths meet together. They then rest for some time in this situation, till the worm breaks between them, and each goes off with his share. But when the mouths of both are thus joined together upon one common prey, a more dangerous combat now and then ensues. The largest Polype gapes and swallows his antagonist; but, what is most wonderful, the animal thus swallowed seems to be rather a gainer by the misfortune. After it has lain in the conqueror's body for about an hour, it issues unhurt, and often in possession of the prey that had been the original cause of contention. The remains of the animal on which the Polype feeds are evacuated at the mouth, the only opening in the body. It is capable of swallowing a worm of thrice its own size: this circumstance, though it may at first appear incredible, is

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the preceding animal, it has the power of contracting its body, in a very sudden manner, when disturbed, so as to appear only like a small green or brownish lump.

SYNONYMS. Hydra viridis. *Linn.*—Hydre verte. *Bosc. Cuvier.*

easily understood, when we consider that the body of the Polype is extremely extensile, and is dilated on such occasions to a surprising degree.

The species are multiplied, for the most part, by a kind of vegetation, one or two, or even more young ones emerging gradually from the sides of the parent animal; and these young are frequently again prolific before they drop off: so that it is no uncommon thing to see two or three generations at once on the same Polype.

But the most astonishing particular respecting this animal is, that if a Polype be cut in pieces it is not destroyed, but is multiplied by dissection: it is thus literally

Rich from its loss, and fruitful from its wound.

It may be cut in every direction that fancy may suggest, and even into very minute divisions, and not only the parent stock will remain uninjured, but every section will become a perfect animal. Even when turned inside-out, it suffers no material injury; for, in this state, it will soon begin to take food, and to perform all its other natural functions.

M. Trembley, of Geneva, ascertained that different portions of one Polype could be engrafted on another. Two transverse sections brought into contact will quickly unite, and form one animal, though each section belong to a different species. The head of one species may be engrafted on the body of another. When one Polype is introduced by the tail into another's body, the two heads unite, and form one individual. Pursuing these strange operations, Mr. Trembley gave scope to his fancy, and, by repeatedly splitting the head and part of the body, formed hydras more complicated than ever struck the imagination of the most romantic fabulists.

These creatures continue active during the greatest part

of the year, and it is only when the cold is most intense that they feel the general torpor of nature. All their faculties are then, for two or three months, suspended. But if they abstain at one time, they make ample amends in their voracity at another; and, like all those animals which become torpid in winter, the meal of one day suffices them for several months.

Animalcules*.

OF THE VORTICELLA TRIBE†.

The Vorticellæ, or Wheel Animals, are the most remarkable of all animalcules, not only in their structure, but also in their habits and production. In general form they bear a great affinity to the polypes, having a contractile, naked body, furnished with rotatory organs round the mouth; and indeed many microscopical writers have denominated them *Cluster-polypes*. They are almost invisibly minute, and generally found in clear, stagnant waters, during the summer months, attached to the stalks of the lesser water plants, where they feed on animalcules still smaller than themselves. Many of the species are found in groups, sometimes formed by the mere approximation of several individuals, and at other times by the ramified or aggregate manner in which they grow. Their various motions, like those of the polypes, are generally exerted only for the purpose of obtaining prey. The rotatory motion of their tentacula cause an eddy in the water, around each individual, sufficient to attract into its vortex such animalcules as happen to swim near; these the little creature seizes, by suddenly contracting its tentacula

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* The animals of the Linnæan order *Infusoria* are extremely simple in their form, and generally invisible without a magnifying power.—They are chiefly found in infusions of animal and vegetable substances.

† In this tribe the animals have a contractile, naked body, furnished with ciliate, rotatory organs.

and enclosing them in the midst. In several of the species the stems, into which they occasionally withdraw themselves, are somewhat rigid or scaly. The young are carried in oval integuments on the outside of the lower part of the stems; and, when ready to issue forth, the parents aid their extrusion, where such is necessary, by writhing their bodies, or striking the little vesicle. As soon as the young one is liberated from its prison, it fixes itself, and commences the necessary operations to procure its food.

THE COMMON WHEEL ANIMALCULE*, AND THE CONVALLARIAN VORTICELLA †.

If the water that is found standing in gutters of lead, or the sediment it has left behind, (observes the Editor of Adams's Essays on the Microscope,) has any appearance of a red or dark brown colour, it will almost always be found to contain these animalcules. And, in the summer time, if a small quantity of this dust be put into water, and placed under the microscope, it seldom fails to yield them in considerable numbers. They are denominated Wheel

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* DESCRIPTION. This very minute animal, which to the naked eye appears only like a yellowish dot, is of a somewhat cylindrical shape. It is furnished with a double rotatory organ; its tail is composed of about three retractile joints, and terminated by four minute hooks.

SYNONYMS. Vorticella rotatoria. *Linnæus.*—Vorticelle rotifère. *Bosc.*—Le Rotifère de Spallanzani. *Cuvier.*—Wheel Animal.

† DESCRIPTION. To the naked eye the Convallarian Vorticella has the appearance of a white point. In the microscope it is seen to be bell-shaped, and not unlike the flower of the Lily of the Valley, or *Convallaria Majalis,* each individual having a long retortile stem.

SYNONYMS. Vorticella convallari a. *Linn*—Vorticelle muguet. *Bosc. Cuvier.*

Animals, from the circumstance of their being furnished with a pair of instruments on the anterior part of their body, which, in figure and motion, somewhat resemble wheels.

These animalcules may be kept for several months out of water, and in a state of perfect dryness, without losing the principle of life. When dry, they are of a globular form, and about the size of a grain of sand. If put into water, after the space of about half an hour a languid motion begins. The globule turns itself about, lengthens by degrees, and soon afterwards becomes very lively. In a short time it protrudes its wheel, and swims about in search of food; or else fixing itself by the tail, brings the food to it by its rotatory organs, which throw the whole circumjacent fluid into a violent commotion. After its hunger is satisfied, it generally becomes quiescent; and sometimes resumes even its globular form.

During the time it is in action, it frequently changes its shape and appearance. And the sudden transformation of the head in particular, are equally surprising and singular. From being very taper, this sometimes becomes, almost instantaneously, as broad as any part of the body, and protrudes its amazingly curious machinery. The circular bodies projecting from the animal in this state, whirl round with considerable velocity. As they are very transparent, the edges excepted, which are set with numerous fibrillæ, it is difficult to distinguish how the rotatory motions are performed; or whether their figure be flat, concave, or conical. They are, however, projected from tubular cases, into which the animal can withdraw them at pleasure. They sometimes turn the same way, and sometimes different ways at the same time.

All the actions of this creature indicate great sagacity and quickness of sensation.

Dr. Shaw, in his Naturalist's Miscellany, informs us,

that the *Convallarian Vorticella* is frequently found on the stalks of the lemma or duckweed, as well as on those of various other aquatic plants, and is one of the most elegant of the whole tribe. It is remarkable for the very sudden and starting manner in which it performs its motions, contracting its stem rapidly, and in a kind of convulsive manner, into a spiral form, and again gradually extending it to its former length.

OF THE VIBRIO TRIBE.

In this numerous tribe, the animals, nearly all of which are invisible to the naked eye, are of a simple, round, and elongated form. Several of them are to be found in vegetable infusions, and some in stagnant water: a few have been discovered in putrid sea water, one in vinegar, and two in paste and infusions of grain.

THE EELS IN PASTE*, AND IN BLIGHTED WHEAT†.

From the general round and elongated form of these animalculæ, all the microscopical writers have been led to distinguish them by the appellation of Eels, although even the most gigantic individuals are seldom the tenth of an inch in length.

In order to procure with certainty those which are found in paste, the Editor of Adams's Essays on the Microscope,

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* Description. These animalculæ are filiform, with a dark shield on the back, surrounded with a white ring. The head is obtuse.

Synonyms. Vibrio glutinis. *Linn.*—L'Anguille de la Colle. *Cuvier.*

† Description. The animals of this species taper towards each end, and are pellucid.

Synonyms. Vibrio anguillula. *Linn.*—Vibrion anguille. *Bosc.*

recommends the following simple process: to boil some flower in water, adding to it a few drops of vinegar; this is to be put into a coarse cloth, and buried in an earthen pot, which has a hole in the bottom, and which is partly filled with earth: the pot is then to be exposed to the heat of the sun in summer, or kept in a warm place in the winter, for ten or twelve days, at the end of which time, if examined with a glass, it will be seen to contain a great abundance of these animalcules, moving about in every direction, with wonderful strength and rapidity.

If, from a small quantity of the paste diluted with water, one of the Eels be separated, and removed, on the point of a fine pen, into a drop of water ready prepared on a separate glass, and there cut asunder with a lancet or very sharp penknife, the mode in which the young ones come to life may at any time be observed. Several oval bodies will be seen to issue from the wound. These are the offspring, in different stages of maturity, each coiled up and enclosed in its proper membrane. The largest and most forward of the group break through this delicate integument, unfold themselves, and wriggle nimbly about in the water. Others escape from their confinement, uncoil themselves, and move more slowly; and those which are least mature, continue entirely without motion. More than a hundred have thus been observed to issue from a single individual. This circumstance will readily account for their very sudden and prodigious increase.

It is an extremely singular circumstance, that in the latter part of the year, and during winter, these Eels are oviparous, whilst at other seasons, they produce living offspring.

The *Eels of Blighted Wheat* are found in those ears, the grains of which appear blackish, as if scorched, and the inside of which contains a soft, white substance. If these

be soaked in water for a few hours, a great number of the animalculæ will be found, some of them sufficiently large to be visible without the aid of magnifying powers.

They are oviparous; and the eggs, when at full growth, are nearly of a cylindrical shape, with both the ends rounded. These issue from two little protuberances at the posterior extremity of the body. In the microscope, two generations may oftentimes be seen at the same time in the same animal, some of them almost in a state of maturity, and others small.

In blighted grains of wheat, which have been kept dry even for years, these animalculæ have been found after a soaking of ten or twelve hours in water.

THE PROTEAN VIBRIO*.

This is a species which has derived its name from its very singular power of assuming different shapes, so as sometimes with difficulty to be distinguished for the same animal. When water, in which any vegetable has been infused, or in which any animal substance is preserved, has stood undisturbed for some days, a slimy substance will be found on the sides of the vessel, some of which, if viewed in a microscope, will be found to contain, among several other animalcules, the Proteus. It is pellucid and gelatinous; and swims about, most commonly, with a long neck and bulbous body, with great vivacity. Sometimes it makes a stop for a minute or two, and stretches itself out apparently in search of prey.—When alarmed, it immediately draws in its neck, becomes more opake, and moves

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* Description. In this minute animalcule, one of the extremities terminates in a sharp point.

Synonyms. Vibrio Proteus. *Linnæus*.—Protée Tenace (Proteus tenax.) *Bosc.*

sluggishly. It will then, perhaps, instead of its former long neck, push out a kind of wheel machinery, the motions of which draw a current of water, and, along with this, probably its prey. Withdrawing the wheel, it will sometimes remain almost motionless for some seconds, as if weary; then protruding its long neck, will often resume its former agility, or, instead, adopt in succession a multitude of different appearances.

OF THE VOLVOX TRIBE.

Of these animalculæ, nearly all the species are invisible to the naked eye. They are simple, pellucid, and of spherical shape. One of the kinds is found in pure water, one in vegetable infusions, and others in water which has been kept in glass. The species hitherto ascertained, are only nine in number.

THE GLOBULAR VOLVOX *.

During the spring and summer months, these animalculæ are every where to be found in stagnant water; and in winter, may be produced in water by an infusion of hempseed or hay. Sometimes they are sufficiently large to be visible by the naked eye. They move round, rolling over and over like a bowl, spinning like a top, or gliding along smoothly without turning at all. Sometimes their motions are very slow, and at other times quick and active. Occasionally they may be seen to turn rapidly round, as if upon an axis, without moving out of their places.

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* Description. This species is spherical, membranaceous, and has upon its body various sized globulets or homogeneous molecules. It is of a greenish or yellowish colour.

Synonyms. Volvox Globator. *Linnæus.*—Volvox globuleux. *Bosc.*—Le Volvoce sphérique. *Cuvier.*

Under the microscope, their bodies seem to be covered with numerous globulets of different sizes. These appear to contain the young, for when in a proper state of maturity, the exterior membrane bursts open, and the young ones pass through the fissure: shortly after this operation, the parent animalculæ die and melt away.

The globulets, while in the body of the parent, contain other globulets, and these again others, so that it may with propriety be said to bear children, grand-children, and great grand-children, all at the same time.

THE BUBBLE VOLVOX*.

I shall conclude this work, with La Martiniere's description of *Volvox Bulla*, a species of animals nearly the most simple of any that have yet come to our knowledge. "They consist (he says) only of oval bodies, similar in shape to soap bubbles, arranged in parties of three, five, six, and nine: among them are also some solitary ones. These collections of globules, being put into a glass filled with sea-water, described a rapid circle round the glass by a common movement, to which each individual contributed by the simple compression of the sides of its body, probably the effect of the re-action of the air with which they were filled. It is not, however, easy to conceive how these distinct animals (for they may be readily separated without deranging their economy) are capable of concurring in a common motion. These considerations, together with the form of the animal, recalled to my mind, with much satisfaction, the ingenious system of M. de Buffon; and I endeavoured to persuade myself, that I was about to witness one of the most wonderful phenomena of nature,

* Description. This animalcule is scarcely visible to the naked eye. It is of a somewhat oval shape, and membranaceous.

Synonym. Volvox Bulla. *Linnæus.*

supposing that these molecules, which were now employed in increasing or diminishing their number, or performing their revolutions in the glass, would soon assume the form of a new animal, of which they were the living materials. My impatience led me to detach two from the most numerous group, imagining that this number might perhaps be more favourable to the expected metamorphosis. I was, however, mistaken. These I examined with more attention than the rest, and the following account is of their proceedings alone. Like two strong and active wrestlers, they immediately rushed together, and attacked each other on every side: sometimes one would dive, leaving its adversary at the surface of the water; one would describe a circular movement, while the other remained at rest in the centre: their motions at length became so rapid, as no longer to allow me to distinguish the one from the other. Having quitted them for a short time, on my return I found them reunited as before, and amicably moving round the edge of the glass by their common exertions."

Quelle magnificence dans le plan de la creation terrestre!
quelle grandeur! quelle profusion!
quelle complaisance à organiser la matiere,
et à multiplier les êtres sentants!
Nous voyons les animaux répandus
sur toute la surface de la terre,
dans toute l'étendue des eaux,
et jusques dans les vastes contours de l'atmosphere.
La Mitte, comme l'Elephant;
le Puceron, comme l'Autruche;
le Vibrio comme la Baleine, ne sont qu'un compose d'animaux;
toutes leurs liqueurs en fournissent;
tous leurs vaisseaux en sont semés!

FINIS